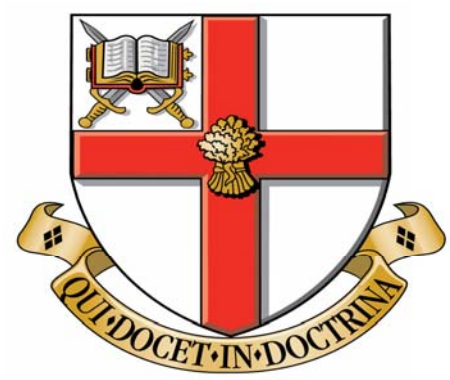

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Evaluation of children's fitness levels across the first year of primary school

By

Claire Heneghan

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Chapter 1: Literature Review

Title:

The impact of physical fitness and activity on primary school children: A review

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Abstract

Childhood obesity has risen to epidemic proportions in recent times. Childhood (5-12 years) is a key period in the primary prevention of obesity and supplementary conditions linked with a sedentary lifestyle. This paper discusses the importance of physical fitness and activity in children and highlights the health risks associated with a sedentary lifestyle. Physical activity recommendations are discussed and research on the activity levels of Irish children is examined. Schools are seen as one of the core agents for the delivery of interventions to combat the obesity epidemic in children. A review of the literature is discussed on fitness and physical activity promotion strategies researched in the school environment. School break-time is highlighted as a fundamental element in the promotion of school-based physical activity and fitness. Break-time strategies and interventions are reviewed. A gap in the literature is exposed on the lack of research investigating the ability of more permanent playground changes to influence physical activity and particularly fitness levels in children during break-time, highlighting the need of further research.

1.1 Introduction

Childhood obesity has emerged as one of the most serious public health challenges of the 21st century. Globally over 40 million children aged up to 12 years are overweight or obese (WHO, 2011). Obesity is usually caused by an imbalance between calories consumed and calories utilized (WHO, 2010). A rise in the consumption of energy dense and highly calorific foods with no equivalent increase in physical activity (PA), results in unhealthy weight gain (WHO, 2010). Low levels of physical activity will also cause an imbalance of energy and lead to an increase in weight (WHO, 2010). Therefore PA and physical fitness have adopted a chief role in the promotion of health and disease prevention in children (Woods, Tannehill, Quinaln, Moyna & Walsh, 2010) and form the basis of this review. Caspersen, Powell and Christenson (1983) defined physical activity as bodily movement generated by muscles that cause energy expenditure. Physical fitness can be defined as a characteristic that has been attained in the performance of physical activity, which is physical movement created by the contraction of muscle that consequently creates energy expenditure (Caspersen, et al. 1985). Physical fitness provides the following health related elements - cardiovascular fitness, muscular endurance, strength and flexibility and healthy body composition (Caspersen, et al, 1985). The improvement in health related fitness has been linked with positive general health results and the diminished risk of the prevalence of disease (Biddle & Mutrie, 2007). Evidence highlights that behavioural patterns established in childhood are sustained throughout adulthood (Twisk, Kemper & van Mechelen, 2000). Childhood (5-12 years) is therefore a key period in the primary prevention of obesity and

supplementary conditions linked with a sedentary lifestyle. Schools are seen as one of the core agents for the delivery of interventions to combat the obesity epidemic (Story, Nanney, & Schwartz, 2009).

1.2 The Rise of Obesity

Obesity and inadequate cardiovascular fitness encompass the rampant health epidemic that is affecting an escalating number of children (WHO, 2012). The World Health Organisation (WHO, 2006) found that a sedentary lifestyle is one of the ten chief worldwide causes of death and disability, with in excess of two million annual deaths attributable to physical inactivity. Indicators associated with physical inactivity are obesity, potential insulin resistance, type 2 diabetes mellitus (T2DM), blood lipid abnormalities, and hypertension (Whitlock, Williams, Gold, Smith & Shipman, 2005). The rate of childhood overweight and obesity is rising globally. Ireland, along with Portugal and Israel, was found to have the highest rate of children who are overweight compared to other European countries (Morgan, McGee, Watson, Perry, Barry & Shelley, 2008). Statistics show that one in every five Irish children is either overweight or obese (Woods, Nelson, O'Gorman & Moyna, 2007).

A comprehensive review of evidence concluded that childhood obesity was an immense health burden in both childhood and adulthood in the developed world (Reilly, Methven & McDowell, 2003). Childhood obesity can have a harmful effect on the body in a variety of ways. Obese children are more likely to have high blood pressure and high

cholesterol, two key risk factors in the development of cardiovascular disease (CVD). Research conducted in 2007 showed that 70% of obese children had at least one CVD risk factor, and 39% had two or more (Freedman, Khan, Dietz, Srinivasan & Berenson, 2001). Additionally obese children have an elevated risk of impaired glucose tolerance, insulin resistance and type II diabetes (Whitlock, et al. 2005).

The increase in childhood obesity has been linked to the dramatic increase in type II diabetes in children (Department of Health and Children, 2009). It is projected that diabetes will be the seventh primary cause of death in 2030 (WHO, 2011). Breathing problems, such as sleep apnea, and asthma (Sutherland, Cowan, Young, Goulding, Grant, Williamson, et al. 2008), joint problems and musculoskeletal discomfort (Taylor, Theim & Mirch, 2006) and Fatty liver disease, gallstones, and gastro-esophageal reflux (heartburn) (Han, Lawlor & Kimm, 2010) are also associated with childhood obesity. Obese children have a greater risk of social and psychological problems, such as discrimination, underachievement in school and poor self-esteem, which can continue into adulthood (Swartz & Puhl, 2003).

If children are overweight, obesity in adulthood is likely to be more severe (Freedman, et al. 2001). The increasing tendency for obesity to persist as children grow older (a feature known as tracking) implies that public health initiatives need to be undertaken at each stage of the life cycle (WHO, 2006). These effects are shown in an intergenerational cycle that creates a vicious circle involving all age groups (see Table 1).

Table 1: Intergenerational cycle of obesity (Source: WHO Europe: The challenge of obesity in the WHO European Region and the strategies for response summary, 2006)

1.3 Why is Physical Activity and Fitness important?

Physical fitness brought about by frequent physical activity has been a vital necessity for the survival of the human race (Booth, et al. 2002). Action, movement and play accumulate to make up the 'culture of childhood' as was suggested by the psychologist Jerome Bruner (1983). However a sedentary lifestyle has been made common by industrialization (Welk & Blair, 2008). Studies show that children, who are deemed the most active of the populace (Ortego, Ruiz & Castillo, 2005), consume an exceeding amount of their time involved in sedentary pursuits such as watching television and playing computer games causing the rates of cardiovascular fitness in children to decline

(Kaur, Kapil & Singh, 2005). In the recent Growing up in Ireland National Longitudinal Study of Children (Layte & McCrory, 2011), 61% of 9-year old children (n=8,568) reported that their PA levels did not meet the guideline of one or more hour(s) of at least moderate intensity activity on five or more days a week.

A study by Sandercock, Voss, McConnell and Rayner (2010) studied the body mass index (BMI) and cardio-respiratory fitness of 10-year old children (n=618) and concluded that in regards to children's health, cardio-respiratory fitness could be more significant than BMI. The participants (n=303) engaged in a 20-metre shuttle run fitness test in 1998 and then a decade later the same test was repeated on a similar number of children (n=315). Researchers found that there was no alteration in BMI of the participants but both genders in 2008 were significantly less fit than their 1998 counterparts. A study by Janssen, Katzmarzyk and Srinivasan (2005) produced supplementary verification that BMI alone has inadequacies for measuring overweight and obesity and that fitness and waist perimeter in conjunction with BMI measurement supplies a more comprehensive picture of health. In this study the elevated frequency of waist perimeter found in 5-18 year olds (n=2597) was a worrying finding as there is a risk of metabolic consequences in central fat (Janssen, et al. 2005).

Research suggests that physical fitness rather the physical activity is a more satisfactory predictor of health outcomes (Blair, Cheng & Holder, 2001). Data collected from an extensive study proposed that increasing physical activity is deficient as the risk of cardiovascular disease is more reliant on physical fitness instead of how much physical

activity is performed (García-Artero, Ortega, Ruiz, Mesa, Delgado & González-Gross, 2007). Alternative studies have differed with this view by conveying that physical exercise performed at both a moderate and intensive level can change adiposity and high intensity physical activity has a positive effect on cardiovascular health in children (Gutin, Barbeau, Owens, Lemmon, Bauman & Allison, 2002; Ruiz, Rizzo, Hurtig-Wennlöf, Ortega, Wärnberg & Sjöström, 2006).

Both physical activity and fitness are inversely related to mortality (Blair, et al. 2001). Studies have shown that physical activity and elevated fitness levels aid to diminish the risk of coronary heart disease (Gottschall, Jones, Mills & Hastings, 2013), hypertension (Hu, Barengo, Tuomilehto, Lakka, Nissinen & Jousilahti, 2004; Paffenbarger, Wing, Hyde & Jung, 1983), stroke (Moore, Hallsworth, Plötz, Ford, Rochester & Trenell, 2013), diabetes mellitus (Mokdad, Ford, Bowman, Dietz, Vinicor, Bales & Marks, 2003), osteoporosis (Hammar & Östgren, 2013), some cancers (Steindorf, Leitzmann & Friedenreich, 2013) and depression (Stephens, 1988; Uebelacker, Eaton, Weisberg, Sands, Williams, Calhoun & Taylor, 2013). Research has shown that cardiovascular disease has its origins in childhood (Ortega, Ruiz, Castillo & Sjöström, 2007) and that the presence of lipid and lipoprotein profiles, hypertension and adiposity in children are likely to endure over their lifespan (Twisk, et al. 2000).

1.4 Physical Activity Recommendations for Children

Children's PA levels have dramatically decreased over the past number of decades (Hands & Larkin, 2002; Stalsberg & Pedersen, 2010). Sedentary pursuits are continuingly replacing outdoor physical play (Grund, Dilba & Forberger, 2000; Hoos, Gerver & Kester, 2003), children are being driven to school instead of walking or cycling and the participation rates in sports and physical leisure activities are in declining (Hoos et al, 2000; Rice & Howell, 2000).

A large array of policy documents and position statements have been produced globally, reflecting the increased awareness and knowledge about the health benefits of habitual physical activity and the trepidation associated with lack of PA (WHO, 2010). The most widely cited physical activity guidelines for children are shown in Table 2. The most broadly accepted PA guideline is that children should engage in 60 minutes of moderate to vigorous activity daily. This guideline is also endorsed by the Health Service Executive (HSE) in Ireland.

Table 2: Guidelines for Physical Activity in Children (5-12 years old)

Organisation/Group	Guideline
World Health Organisation (2010)	At least 60 minutes daily of moderate intensity exercise. Exercise incorporating muscle strength and flexibility should be completed at least two times per week.
US Department of Health and Human Sciences (2010) Surgeon General Report	60 minutes of physical activity on most, preferably all, days of the week.
Health Service Executive – Get Ireland Active (2009)	At least 60 minutes daily of moderate intensity physical activity.
UK Physical Activity Guidelines, Department of Health (2011)	At least 60 minutes daily of moderate intensity physical activity.
Australian Department of Health and Aging (2013)	Moderate to vigorous intensity physical activity For 60 minutes daily.
The Canadian Society for Exercise Physiology (2013)	Recommendation of 60 minutes daily of moderate to vigorous physical activity.

1.5 Activity levels of Irish children

From the Growing up in Ireland study (Layte, et al. 2011), it emerged that only 25% of children (n=8,568) met the recommendation of sixty minutes of moderate to vigorous physical activity per day. 29% of boys were reported to meet the WHO (2009) recommendation compared to 21% of girls. Similar patterns were seen in regards to children's self reported sport participation. Even though an extremely high majority of 97% of children stated that they played sport at least once weekly, the research showed that boys were 56% more likely reported to partake in sport almost everyday compared to 33% of girls. As there is a proven link between physical inactivity and weight control (Saxena, Van Ommeren, Tang & Armstrong, 2005), these findings indicate that the gender difference in overweight and obesity may be counteracted by increasing exercise levels among girls (Layte, et al. 2011). Significantly 24% of girls who did not engage in

sports stated that ‘no opportunities to play’ was their main reason for not participating compared to 3% of boys (Layte, et al. 2011).

Consistent with these findings, the Children’s Sport Participation and Physical Activity study (CSPPA) found that 19% of 5 to 12-year old primary school children (n=1,275) met the 60 minutes of moderate to vigorous physical activity daily recommendation. Girls were also shown to be less likely to meet the target recommendations in comparison to boys. A quarter of the children who participated in the study were overweight or obese, unfit and had hypertension (Woods, et al. 2010). Coherent with these outcomes and in spite of differing modes of assessment on PA levels across the many studies on the topic completed globally (Cale & Almond, 1992; Cooper, Andersen, Wedderkopp, Page & Froberg, 2005; Dale, Corbin & Dale, 2000; Ridgers, Stratton & Fairclough, 2006), the following conclusions can be drawn.

1. Low activity levels are common among children.
2. Physical Activity decreases with age.
3. Gender differences are evident in PA levels.
4. No clear urban/rural differences exist.

1.6 Measuring Fitness Levels in Children

Longitudinal and cross sectional studies on the associations between physical activity, physical fitness and health are limited and have not gathered consistent results (Marshall & Bouffard, 1997; Stalsberg & Pedersen, 2010). Consequently the intensity,

duration and frequency of PA in children and how it affects their physical fitness are continuingly coming under review. For such relationships to be tested in children, reliable fitness tests are needed. While a number of fitness tests are available for the adult population, these are generally deemed unsuitable for children (Kemper & Van Mechelen, 1996). Isolated physiological areas, such as aerobic endurance and muscle strength, are targeted for these fitness tests using technological equipment in laboratories. High emphasis is placed on endurance and the compliance and ability of the partaker to follow exact instructions, which may deem this process as unsuitable for testing young children. Additionally laboratory fitness tests are unfeasible for large groups as they are expensive and need highly skilled analysts (Rice, et al. 2000; Kemper, et al. 1996; Safrit, 1990).

From the literature available on children's fitness testing, the EUROFIT motor fitness test (Council of Europe, 1993) is applicable to primary school children with slight modifications recommended for younger primary school children (Fjørtoft, 2000; Fjørtoft, Pedersen, Sigmundsson & Vereijken, 2011). Throughout this model compound activities are targeted, for example endurance, running speed, agility, strength, balance and flexibility (Fjørtoft et al. 2011; Haga, 2008; Haga, 2009). Familiar pursuits that children engage in during play are focused on, ensuring cognitive understanding. For the measurement of younger primary school children's balance levels (aged 5-7 years), the static standing balance test was recommended by Clarke & Watkins (1984), as the reproducibility was rated low on EUROFIT's Flamingo Balance test for the 5-7 year old

age group (Fjørtoft, 2000). The sit and reach test measures flexibility. Strength is tested by the Bent Arm Hang Test and the Sit-Up Test. Running speed and agility is tested by a 10x5 metre shuttle run (Council of Europe, 1993).

Table 3: EUROFIT Fitness Tests (Council of Europe, 1993)

Measurement	Test
Running speed/agility	10x5 metre shuttle run
Strength	1. Bent Arm Hang 2. Sit-up Test
Balance	Flamingo Balance Test (Standing Balance Test-5-7 years (Clarke & Watson, 1984))
Flexibility	Sit and Reach Test

The EUROFIT fitness model was chosen over other fitness tests such as the Fitnessgram (Cooper Institute for Aerobics Research, 2001) due to the fact that it allows for the long term monitoring of children's fitness. The model is not subdivided into different age brackets so the same tests can be administered from the ages 5-12.

1.7 School – A key setting in promotion of physical activity

Both international and national policy have acknowledged the school as being a key setting for the promotion of PA in young people due to the fact that almost all children attend school. Irish Primary School children are required to spend 183 days at school annually (Department of Education and Skills, 2012). Therefore schools are seen as key settings to promote physical activity and cardiovascular fitness (Tudor-Locke, Lee,

Morgan, Beighle, & Pangrazi, 2006). The school environment provides numerous opportunities for children to be physically active, including physical education (PE) lessons and break times. Break-time is defined as a regular scheduled time for children to partake in unstructured physical activity and free play (Sarkin, McKenzie & Sallis, 1997).

The Primary School Curriculum (Government of Ireland, 1999) advocates thirty minutes of recreation per day and a further break of ten minutes daily. One study found that children's engagement in PA during such non-curricular school time can contribute up to 40% of the recommended daily 60 minutes (Ridgers, et al. 2006). Many intervention studies have concentrated on PE classes to enhance children's PA levels at school (McKenzie, Nader & Strikmiller, 1996; McKenzie, Sallis & Prochaska, 2004; Sallis, McKenzie & Alcaraz, 1997). In the majority of cases, however, PE sessions fail to supply adequate activity for children to comply with the recommendation of 60 minutes or more of moderate to vigorous physical activity (MVPA) on five or more days per week (Biddle et al, 2004; McKenzie, Marshall, Sallis & Conway, 2000; Friedman, Belsky & Booth, 2003).

The Primary School Curriculum (Government of Ireland, 1999) recommends sixty minutes per week of physical education. As curriculum time scheduled for PE is limited, break-time is a key environmental opportunity for the promotion of PA as it is incorporated into more periods each day.

1.8 Physical Activity and Break Time

The majority of Irish Primary School children spend 5 hours and 40 minutes every week day in school with 40 minutes allotted for break-time. Break-time, therefore, constitutes nearly one eighth of the school day. This time is considerably less than the quarter of the school day which is assigned to break-time in for example British schools (Sleap & Warburton, 1996). In Britain, lunch breaks amount to 75 minutes long per day, with 45 minutes assigned for break-time (Sleap, Warburton & Waring, 2000), while in Australia one sixth of the school day is assigned to break-time (McKenzie & Kahan, 2008). Therefore when evaluating research, differences should be taken into account because of the lack of standardization across countries concerning the purpose and structure of break-time (McKenzie, et al. 2008).

Break-time can play a role in children's social, emotional and cognitive development and studies show that breaks where children can partake in physical activity led to an improvement in children's alertness, attentiveness and improved classroom behaviour (Jarrett, Maxwell, Dickerson, Hoge, Davies & Yetley, 1998; Pellegrini, Huberty & Jones, 1995).

Break-time has a multidisciplinary function and supplies an 'extended classroom' for children, in which its benefits can be brought back to the classroom (Pellegrini & Blatchford, 2002). The Positive Playground and Evaluation Report (2008) described most Irish school playgrounds as being 'flat and uninspiring pieces of tarmac' (Playboard,

2008). In another Irish Study analyzing break-time play in 391 Irish Primary Schools, the equipment in use during break-time was defined as 'scarce and basic' (Marron, 2008) and did little to boost a sense of pride or aesthetic awareness in the children. School playgrounds should be aesthetically pleasing with quality landscapes where both formal and informal learning can take place (Marron, 2008). No published data on the number of schools in Ireland with fixed playground equipment was available at the time of print.

The characteristics of break-time supervision differ from country to country (Pellegrini, et al. 2000). Irish primary school teachers are paid to supervise during break-time on a timetabled basis. Most primary schools have a break-time supervision policy in place, while only the minority has a play or break-time policy (Marron, 2008), even though research has shown that school play and activity policies do influence PA levels (Haug, Torsheim & Samdal, 2009; Leatherdale, Manske, Faulkner, Arbour & Bredin, 2010). Additionally the use of the yard book, where teachers document misbehaviour, is a common commodity in Irish primary schools, which can bring a negative element to break time (Marron, 2008).

The quality of PE teaching offered to the children can play a major role in the stimulation of physical activity during break-time. Children were seen to instigate activities during break-time that they found enjoyable and challenging in class (Kraft, 1989). Additionally in an Irish study, Cosgrave (2006) emphasized that junior or senior infant children were seen to be reluctant to use playground markings in the playground

if they were not taught how to use them. Studies show that the activities that boys and girls carried out during break-time varied (Kraft, 1989; Pellegrini et al. 2004; Waring, Warburton & Coy, 2007). Children (n=129) were likely to play with peers of the same sex at break-time (Blatchford, Baines & Pellegrini, 2003). Boys tended to engage in vigorous and competitive play, which dominated the yard space (Pellegrini, Blatchford, Kato & Baines, 2004). Girls were more inclined to partake and play in a far greater number of activities but in smaller groups and were more emotionally connected to peers (Waring et al. 2007; Kraft, 1989).

From the literature reviewed, break-time was the most significant source of daily physical activity for both genders during school hours (McKenzie, et al. 2000; Sutterby, Brown & Thornton, 2004; Waring, et al. 2007; Zask, van Beurden, Barnett, Brooks & Dietrich, 2001). Play at break-time was shown to contribute between 5-40% of recommended daily physical activity levels when no interventions were in place (Ridgers, Stratton & Fairclough, 2005). A threshold of 40% physical activity during break-time was what was advocated by Stratton and Mullan (2005).

1.9 Safety during Break Time

Safety is a major concern in primary schools and it has an effect on every practice within a school. There is a certain amount of risk associated with PA at break-time. Recent research deemed that over-exaggerated focus on safety issues in children's play environments is problematic as it can lead to children being restricted from practices and experiences that are influential to their general development (Ball, 2002; Sandseter, 2011). A Health Service Executive report (Murray & Millar, 2005) stated that 40% of fifty randomly selected primary schools in the south of Ireland had applied a no running policy during break-time. 75% of schools with an enrolement of 300 or more students had such a policy implemented in comparison to 29% of schools with less than 300 students. The Irish Primary Principals Network argued that the reason this policy is put in place in some schools is because of lack of space for children to run safely (RTE, 2005).

The role of the Board of Management in each school is to choose the suitable amount of supervisors needed to fit the size of the school play area, taking into account the age and number of children participating in PA in that said area. Risk evaluation is crucial and all equipment and play areas should be monitored regularly (Marron, 2008). Yet Ball (2002) suggests that the risk against the developmental benefit of risky play should be considered. Engagement in play in environments that are stimulating and challenging will promote risk management which in itself aids accident prevention (Ball, 2002). Children should also be instructed on how to properly use the equipment available

during break time. Reluctance was seen in children (aged 5-6 years) to use equipment available during break-time if they had not been taught how to use it (Cosgrave, 2006).

1.10 Influence of the physical environment in the promotion of children's activity levels at school

Over the past decade the physical environment and its effect on PA has been significantly highlighted in public health research. This may be due to the fact that research completed on children's activity levels during break-time has shown that children spent less than 40% of play time engaged in moderate to vigorous physical activity (Commission of the European Communities, 2007; Story, Kaphingst & French, 2006; Trudeau & Shephard, 2005). This has lead to an increase in studies on attributes of the environment and their link with physical activity. Many of these studies have concentrated on the associations between the physical environment and adult's level of physical activity (Davison & Lawson, 2006). There has been much less research completed in this area on children, particularly in an Irish context. Yet generally the majority of environmental changes in the school playground researched brought about positive results in the elevation of PA in children (Ridgers, et al. 2006; Stratton & Leonard, 2002; Stratton, et al. 2005).

The literature suggests different methods to increase children's PA levels at break-time. In an American study, activity levels were measured on 4-7 year old children (n=287),

who had been exposed to social prompting and encouragement for physical activity during break-time (McKenzie, Sallis & Elder, 1997). Activity and associated interactions were documented at preschool and again over two years later. Children engaged in nearly twice as much PA at preschool break-time than at elementary break time. The findings also revealed that school children in this age bracket were responsive to social prompts for physical activity from both adults and peers (McKenzie, et al. 1997).

Sallis, Prochaska and Taylor (2000) reviewed the predictors of physical activity amongst children. One hundred and eight studies on the associations between the physical environment and physical activity in children were reviewed. It was established that both fixed playground equipment and activity-related equipment resulted in children being more physically active during break-time. Additionally research observing the effect of playground markings on 5-7 year old children's physical activity (n=99) showed considerable increases in the children's activity levels from moderate to vigorous activity and vigorous activity in the intervention schools compared to control schools (Stratton & Mullin, 2005). The availability of sports facilities and athletic features in schools were also linked with elevated self reported physical activity in a Canadian study (Fein, Plotnikoff, Wild & Spence, 2004).

Only a small proportion of studies have researched the impact of characteristics of the school environment and fixed playground equipment on children's activity and fitness levels during break-time. Assessment of one play area in New Orleans demonstrated

that children were between 3.3 to 12.6 times more likely to be active in equipped play areas (Farley, Meriwether, Baker, Rice & Webber, 2008). Additionally the amount of permanent play facilities in school playgrounds were associated with higher PA (3.2%) level in 5-12 year old children (n=441) in a New Zealand study (Taylor, Farmer, Cameron, Meredith-Jone, Williams & Mann, 2011). A study by Sutterby, et al. (2004) found that children (n=120) using fixed playground equipment in school resulted in a significant increase in children's heart rates in comparison with heart rates levels of children in equipment free play areas. Across all age groups in the school with fixed equipment, elevated heart rates in the children were found during break-time. This is pertinent in relation to both girls and older children whose levels of activity have been shown to decrease with age. Additionally children in this study who are classified as obese, with a BMI ranging from 18.9 in 6 year olds to 23.3 in 10 year olds (Ogden, Kuczmarski, Flegal, Mei, Guo, Wei, et al. 2002), attained equal levels of activity as children in the healthy range during break-time when they had access to fixed equipment (Sutterby et al. 2004). Children engaged significantly more in physical activity during free play with access to fixed equipment compared to PE class, which suggest that restructuring the playground environment to permit ample opportunity for structured physical activity can enhance children's school time physical activity levels (Sutterby et al. 2004).

In other research, school children aged from 4-7 years old were shown to be significantly more active during break-time when games were implemented by playground supervisors (Connolly & McKenzie, 1995). Children's PA levels (n=263) were

also amplified during fitness breaks in comparison with traditional break-time in a study by Scruggs, Beveridge and Watson (2003). Boys tended to prefer fitness breaks in this study, in comparison to girls whose preference was for free play during break-time. Enjoyment is a crucial factor in the promotion of physical activity during break-time (Sallis et al. 2000; Scruggs et al. 2003; HSE, 2005). Scruggs et al. (2003) adhered to the development and educational advantages of free and unstructured play and that fitness breaks should not replace them.

School policies can affect the physical activity and cardiovascular fitness levels of children. This relates to whether the equipment is being utilised during break-time, if supervisors are encouraging physical activity (Ridgers, Stratton, Fairclough & Twisk 2007) and if children are trained how to use playground equipment and markings correctly during PE lessons (HSE, 2005). Through implicit or explicit policies, schools can endorse certain procedures at break-time that effect children's physical activity levels. Well thought out alterations may promote and inspire children to be more active (Marron, 2008).

1.11 Physical Education at primary level

Physical self concept and confidence are key factors for children to engage in physical activity and sport (Daley, 2002). If skills to engage in the activity are not honed in the child, when given the option they will not maintain participation, and because of lack of practice and exposure incompetence will follow (Daley, 2002). Physical Education offers

the foundation on which safe and ongoing physical activity models are created (Daley, 2002). The justification for Irish primary school children to be allocated just over half of the European Union average of 109 minutes of PE classes per week is unclear (Woods, et al. 2010). Yet Irish primary teachers have identified that there is insufficient time to adequately cover all eleven curricular subjects due to an overloaded curriculum (NCCA, 2010). 52% of total teaching time in primary schools is awarded to English, Irish and Mathematics. This leaves eight subjects, including PE, competing for 48% of the remaining instructional time (NCCA, 2010). Consequently the European Union Education Information Network (2013) found that Irish primary schools offered less hours of PE than any other EU member state, where 45 hours of PE per annum is the minimum.

The physical education curriculum is divided into different sections or strands - athletics, aquatics, outdoor and adventure activities, dance, gymnastics, games and fitness (Government of Ireland, 1999), all of which play a role in the overall aims and objectives of physical education curriculum. The role of play and its significance in the developmental and educational process is emphasized – "Play in PE contributes to the child learning to become an effective mover, to think, to interact socially with others and to express feelings" (Government of Ireland, 1999).

Since 2004 the regularity of PE classes has improved. 31% of principals stated that PE was undertaken two to three days per week in 2004 (Fahey, Delaney & Gannon, 2005). By 2009 it had risen to 53%. Correspondingly the amount of schools partaking in

physical education only once per week has dropped from 62% in 2004 to 42% in 2009 (Woods, et al. 2010). Yet only 35% of primary school children met the Department of Education's recommended sixty minutes of physical education per week. Forty six minutes per week was reported as being the average amount of physical education received weekly by primary school pupils. Girls were reported as receiving less physical education time than boys in this study (Woods, et al. 2010). The Department of Education and Skills acknowledged a decade ago that the availability of amenities and resources was dependant on the ability of schools to offer a fully balanced physical education curriculum (Department of Education and Science, 2003). Appropriate indoor and outdoor areas were also endorsed by the Department of Education and Skills (Department of Education and Science, 2003). However Woods et al. (2010) found that 81% of primary school principals stated that they had no access to an on-site multi-purpose hall for carrying out PE lessons. Investment is required in school amenities and qualified educators who are competent and skilled in a wide variety of physical activities and games. Even though the advantages of regular physical activity are well validated, 2% of primary school children are not doing any physical education in school (Woods, et al. 2010). 'Fear of injury' and 'lack of skill' are the chief obstacles which students reported as being the main reasons for lack of participation in PE (Woods, et al. 2010).

1.12 Summary

Research from this review of literature has shown that school age children are failing to meet PA guidelines, with girls being less active than boys. Research has appropriately identified schools as being a key setting in the execution of fitness and PA promotional strategies (Biddle, et al. 2007; Tudor-Locke, et al. 2006). Children generally have two outlets for physical activity in school: PE and break-time. PE alone is not enough to provide adequate PA to meet recommendations needed for health benefits (Biddle, Gorely & Stensel, 2004; Ridgers et al. 2007). Consequently break-time is a fundamental element in the promotion of school-based PA and fitness (Stellino & Sinclair, 2008). As a result the break-time environment should encourage children to be physically active. Relatively positive benefits have been shown in research by adapting playgrounds and installing fixed playground equipment and playground markings to encourage more PA in children at school (Sutterby et al. 2004; Ridgers et al. 2007, Farley, et al. 2008). Little research has investigated the ability of more permanent playground changes to influence PA and fitness in children during break-time. To date there seems to have been no Irish study, and very few international studies, that have investigated the impact of fixed playground equipment at break-time on children's fitness levels. The hypothesis proposed is that regular use of permanent playground equipment, in comparison to an equipment-free outdoor play area, will increase children's fitness levels over the academic year.

1.13 References

Active Healthy Kids Canada (2009). *Report Card on Physical Activity for Children and Youth.* Public Health Agency of Canada.

Australian Department of Health and Ageing (2013) *Australia's Physical Activity Recommendations for 5-12 year olds*, Canberra.

Ball, D. J. (2002). *Playgrounds - Risks, benefits and choices* (Vol. 426/2002). London: Health and Safety Executive (HSE) contract research report, Middlesex University.

Biddle SJH, Gorely T & Stensel DJ (2004). Health-enhancing physical activity and sedentary behaviour in children and adolescents. *Journal of Sport Science*; *22:679*–701.

Biddle, S. J., & Mutrie, N. (2007). Psychology of physical activity: Determinants, well-being and interventions. *Routledge*.

Biro, F. M., & Wien, M. (2010). Childhood obesity and adult morbidities. *The American journal of clinical nutrition*, *91*(5), 1499S-1505S.

Blatchford, P, Baines, E & Pellegrini, A. (2003). The social context of school playground games: Sex and ethnic differences, and changes over time after entry to junior school. *British Journal of Developmental Psychology*, *21*(4), 481-505.

Blair SN, Cheng Y & Holder JS (2001). Is physical activity or physical fitness more important in defining health benefits? *Medicine & Science in Sports & Exercise;* 33:S379-99.

Boreham, C., & Riddoch, C. (2001). The physical activity, fitness and health of children. *Journal of sports sciences*, *19*(12), 915-929.

Booth FW, Chakravarthy MV, Gorden SE & Spangenburg EE (2002). Waging war on physical inactivity, using mordern molecular ammunition against an ancient enemy. *Journal of Applied Physiology*; 93:3–30.

Bruner, JS (1983). *Child's Talk.* Oxford: Oxford University Press

Cale, L. A., & Almond, L. (1992). Children's activity levels: a review of studies conducted on British children. *Physical Education Review*, *15*(2), 111-118.

Canadian Society for Exercise Physiology (2013). *Physical Activity Guidelines for children 5-11 years*. CSEP. Retrieved February 28th 2013 http://www.csep.ca/english/view.asp?x=804

Caspersen, C. J., Powell, K. E., & Christenson, G. M. (1985). Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public health reports*, *100*(2), 126.

Cavill N, Biddle S & Sallis JF (2001). Health enhancing physical activity for young people: Statement of the United Kingdom Expert Consensus Conference. *Pediatric Exercise Science*; *13:12*–25

Canadian Fitness and Lifestyle Research Institute (CFLRI) (2008). *Canadian Physical Activity Levels Among Youth, 2005-2008*. Public Health Agency of Canada.

Clark, J. E., & Watkins, D. L. (1984). Static balance in young children. *Child development*, 854-857.

Commission of the European Communities (2007). *White Paper on a Strategy for Europe on Nutrition, Overweight and Obesity Related Health Issues.* White Paper. Brussels*:* Commission of the European Communities*; p.* 12*.*

Connolly P & McKenzie TL (1995). Effects of a games intervention on the physical activity levels of children at recess. *Research Quarterly for Exercise and Sport*; *66*:*A60*.

Cooper, A. R., Andersen, L. B., Wedderkopp, N., Page, A. S., & Froberg, K. (2005). Physical activity levels of children who walk, cycle, or are driven to school. *American journal of preventive medicine*, *29*(3), 179-184.

Cooper Institute for Aerobics Research (2001). *The Prudential Fitnessgram : Test Administration Manual.* Dallas, Texas

Cosgrave C (2006). *Teaching physical education in junior and senior infants: practices and perspectives.* St. Patrick's College, Dublin City University

Council of Europe. Committee for the development of sport. Committee of experts on sports research. (1993). *EUROFIT: Handbook for the EUROFIT Tests of Physical Fitness*. Council of Europe.

Chróinín, D. N., Murtagh, E., & Bowles, R. (2012). Flying the 'Active School Flag': physical activity promotion through self-evaluation in primary schools in Ireland. *Irish Educational Studies*, *31*(3), 281-296.

Dale, D., Corbin, C. B., & Dale, K. S. (2000). Restricting opportunities to be active during school time: Do children compensate by increasing physical activity levels after school?. *Research Quarterly for Exercise and Sport*, *71*(3), 240-248

Daley AJ (2002). Extra-Curricular Physical Activities and Physical Self-Perceptions in British 14-15-Year-Old Male and Female Adolescents. *European Physical Education Review*; 8(1):37

Davison KK & Lawson CT (2006). Do attributes in the physical environment influence children's physical activity? A review of the literature*. International Journal of Behavioural Nutrition and Physiology Act;* 3*:*19*.*

Deenihan, J. (2005). Physical education provision in primary schools. *Unpublished survey). Dublin Fine Gael*.

Department of Education and Science (2003). *Junior Cycle Physical Education*. Dublin: The Stationery Office.

Department of Health and Children. (2009). *The national guidelines on physical activity for Ireland*. Dublin: Department of Health and Children.

Department of Education and Skills (2012). *School self-evaluation: Draft guidelines for primary schools*. Dublin: Department of Education and Skills.
Department of Health (2004). *At least 5 a week: Evidence on the impact of physical activity and its relationship to health–a report by the Chief Medical Officer*. London

Duncan, M. J., Spence, J. C., & Mummery, W. K. (2005). Perceived environment and physical activity: a meta-analysis of selected environmental characteristics. *International Journal of Behavioral Nutrition and Physical Activity*, *2*(1), 11.

Economic and Social Research Institute (2012), *Growing up in Ireland National Longitudinal Study of Children*
European Commission/EACEA/Eurydice, 2013. *Physical Education and Sport at School in Europe* Eurydice Report. Luxembourg: Publications Office of the European Union.

Fahey, T., Delaney, L., & Gannon, B. (2005). School children and sport in Ireland. *Dublin: Economic and Social Research Institute ESRI.*

Farley, T. A., Meriwether, R. A., Baker, E. T., Rice, J. C., & Webber, L. S. (2008). Where do the children play? The influence of playground equipment on physical activity of children in free play. *Journal of physical activity & health*, *5*(2), 319.

Fein AJ, Plotnikoff RC, Wild C & Spence JC (2004). Perceived environment and physical activity in youth. *International Journal of Behavioural Medicine*, 11(3):135-142

Ferreira I, van der Horst K & Wendel-Vos W (2007). Environmental correlates of physical activity in youth—a review and update*. Obesity Reviews;* 8*:*129-54*.*

Fjørtoft, I. (2000). Motor fitness in pre-primary school children: The EUROFIT motor fitness test explored on 5-7-year-old children. *Pediatric Exercise Science*, *12*(4), 424-436.

Fjørtoft, I., Pedersen, A. V., Sigmundsson, H., & Vereijken, B. (2011). Measuring physical fitness in children who are 5 to 12 years old with a test battery that is functional and easy to administer. *Physical Therapy*, *91*(7), 1087-1095.

Freedman DS, Khan LK, Dietz WH, Srinivasan SR & Berenson GS (2001). Relationship of childhood overweight to coronary heart disease risk factors in adulthood: The Bogalusa Heart Study. *Pediatrics* 108:712—718.

Freedman, D. S., Mei, Z., Srinivasan, S. R., Berenson, G. S., & Dietz, W. H. (2007). Cardiovascular risk factors and excess adiposity among overweight children and adolescents: the Bogalusa Heart Study. *The Journal of pediatrics*, 150(1), 12-17.

Friedman SL, Belsky J & Booth C (2003). Frequency and intensity of activity of third-grade children in physical education. *Archives of Pediatric and Adolescent Medicine*;157:185–90.

Friedman HS, Martin LR, Tucker JS, Criqui MH, Kern ML, & Reynolds CA (2008). Stability of physical activity across the lifespan. *Journal of health psychology*, *13*(8), 1092-1104.

Frost J, Pei-San Brown J, Sutterby J & Thornton C (2004). *The Developmental Benefits of Playgrounds*. Olney, Maryland: Association for Childhood Education International

García-Artero E, Ortega FB, Ruiz JR, Mesa JL, Delgado M & González-Gross M (2007). Lipid and Metabolic Profiles in Adolescents Are Affected More by Physical Fitness Than Physical Activity (AVENA Study).*Revista Española de Cardiología (English Version)*;60:581-8.

Gottschall JS, Jones JL, Mills J & Hastings B (2013). Group fitness is effective in reducing cardiovascular disease risk factors in healthy adults.

Government of Ireland (1999). *Physical education curriculum*. Dublin: The Stationery Office

Grund, A., Dilba, B., Forberger, K., Krause, H., Siewers, M., Rieckert, H., & Müller, M. J. (2000). Relationships between physical activity, physical fitness, muscle strength and nutritional state in 5-to 11-year-old children. *European journal of applied physiology*, *82(5-6), 425-438.*

Gutin B, Barbeau P, Owens S, Lemmon CR, Bauman M & Allison J, 2002. Effects of exercise intensity on cardiovascular fitness, total body composition, and visceral adiposity of obese adolescents. *American Journal of Clinical Nutrition*; 75:818-26.

Haga, M. (2008). The relationship between physical fitness and motor competence in children. *Child: care, health and development*, *34*(3), 329-334.

Haga, M. (2009). Physical fitness in children with high motor competence is different from that in children with low motor competence. *Physical Therapy*, *89*(10), 1089-1097.

Haug E, Torsheim T, Samdal O (2009): Local school policies increase physical activity in Norwegian secondary schools. *Health Promotion International*, 25:63-72

Hammar M & Östgren CJ (2013). Healthy aging and age-adjusted nutrition and physical fitness. *Best Practice & Research Clinical Obstetrics & Gynaecology*.

Han JC, Lawlor DA, Kimm SY (2010). Childhood obesity. *Lancet.* 375(9727):1737—1748.

Hands, B., & Larkin, D. (2002). Physical fitness and developmental coordination disorder. *Developmental coordination disorder*, 172-184.

Health Service Executive (2005). *An Evaluation of playground games and markings project.* HSE, Midland Area

Hoos, M. B., Gerver, W. J. M., Kester, A. D., & Westerterp, K. R. (2003). Physical activity levels in children and adolescents. *International journal of obesity, 27(5), 605-609.*

Hu G, Barengo NC, Tuomilehto J, Lakka TA, Nissinen A & Jousilahti P (2004). Relationship of physical activity and body mass index to the risk of hypertension: a prospective study in Finland. *Hypertension*, *43*(1), 25-30.

Humpel N, Owen N & Leslie E (2002). Environmental factors associated with adults' participation in physical activity: a review. *American Journal of Preventive Medicine*, 22(3):188-199.

Ian, J., & Allana, L. (2010). Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *International Journal of Behavioural Nutrition and Physical Activity*, *7*.

Jago, R. & Baranowski, T. (2004). Non-curricular approaches for increasing physical activity in youth: a review. *Preventive Medicine*; 39:157–63.

Janssen I, Katzmarzyk P T & Srinivasan S R (2005). Combined influence of body mass index and waist circumference on coronary artery disease risk factors among children and adolescents. *Pediatrics*. 1151623–1630.1630.

Jarrett, O. S., Maxwell, D. M., Dickerson, C., Hoge, P., Davies, G., & Yetley, A. (1998). Impact of recess on classroom behavior: group effects and individual differences. *The Journal of educational research*, 92(2), 121-126.

Kannus, P., Sievänen, H., & Vuori, I. (1996). Physical loading, exercise, and bone. *Bone*, *18*(1), S1-S3.

Kaur S, Kapil U & Singh P (2005). Patterns of chronic disease amongst adolescent obese children in developing countries. *Current Science*; 88:1052–6.

Katzmarzyk PT, Gagnon J &Leon AS (2001). Fitness, fatness, and estimated coronary heart disease risk: the HERITAGE Family Study. *Medicine and Science in Sports and Exercise*; 33585- 590

Kemper HCG & van Mechelen W (1996). Physical fitness testing of children: a European perspective. *Pediatric Exercise Science*;8:210–214.

Kraft, R. E. (1989). Children at play: Behavior of children at recess. *Journal of Physical Education, Recreation & Dance*, *60*(4), 21-24.

Layte, R. & McCrory, C. (2011). *Growing up in Ireland: National longitudinal study of Children*. Dublin: Department of Children and Youth Affairs.

Leatherdale ST, Manske S, Faulkner G, Arbour K, Bredin C (2010): A multi-level examination of school programs, policies and resources associated with physical activity among elementary school youth in the PLAY-ON study**.** *International Journal of Behavioural Nutritional and Physical Activity*, **7:**6

Lee C & Moudon AV (2004). Physical activity and environment research in the health field: Implications for urban and transportation planning, practice and research. *Journal of Planning Literature*, 19(2):147-181

Marron, S. (2008). *An analysis of break time active play in Irish primary schools* (Doctoral dissertation, Waterford Institute of Technology).

Marshall, J. D., & Bouffard, M. (1997). The effects of quality daily physical education on movement competency in obese versus nonobese children. *Adapted Physical Activity Quarterly*.

McKenzie TL, Nader PR & Strikmiller PK (1996). School physical education: effect of the child and adolescent trial for cardiovascular health. *Preventative Medicine*;25:423–31.

McKenzie TL, Sallis JF & Elder JP (1997). Physical activity levels and prompts in young children at recess: a two-year study of a bi-ethnic sample. *Research Quarterly for Exercise and Sport*; 68:195–202.

McKenzie TL, Marshall SJ, Sallis JF& Conway TL (2000). Student activity levels, lesson context, and teacher behavior during middle school physical education. *Research Quarterly for Exercise and Sport;71:249–59.*

McKenzie TL, Sallis JF & Prochaska JJ (2004). Evaluation of a two-year middle-school physical education intervention: M-SPAN. *Medicine and Science in Sports and Exercise*; 36:1382–8.

McKenzie, T. L., & Kahan, D. (2008). Physical activity, public health, and elementary schools. The Elementary *School Journal*, *108*(3), 171-180.

McMillan TE (2005). Urban form and a child's trip to school: The current literature and a framework for future research. *Journal of Planning Literature*, 19(4):440-456.

Mokdad AH, Ford ES, Bowman BA, Dietz WH, Vinicor F, Bales VS & Marks JS (2003). Prevalence of obesity, diabetes, and obesity-related health risk factors, 2001. *JAMA: the journal of the American Medical Association*, *289*(1), 76-79.

Moore SA, Hallsworth K, Plötz T, Ford GA, Rochester L, & Trenell MI (2013). Physical Activity, Sedentary Behaviour and Metabolic Control following Stroke: A Cross-Sectional and Longitudinal Study. *PloS one*, *8*(1), e55263.

Morgan K, McGee H, Watson D, Perry I, Barry M & Shelley E (2008). *Survey of Lifestyle, Attitudes and Nutrition in Ireland*: SLAN 2007

Murray, D. & Millar, N. (2005). *Physical Activity in Primary Schools-Facilities and practices. Our children…their future…why weight?* Health Service Executive

National Council for Curriculum and Assessment (NCCA), (2010). *Curriculum overload in primary schools: An overview of national and international experiences. http://www.ncca.ie/en/Curriculum_and_Assessment/Early_Childhood_and_Primary_Education/Primary_School_Curriculum/PSN_Curriculum_Overload/Overview_national_international_experiences.pdf*

Ortega FB, Ruiz JR & Castillo MJ (2005); Group AVENA. A low level of physical fitness in Spanish adolescents. Relevance for future cardiovascular health (AVENA Study). *Revista Española de Cardiología (English Version);* 58:898–909.

Ortega FB, Ruiz JR, Castillo MJ, Sjöström M (2007). Physical fitness in

childhood and adolescent: A powerful marker of health. *International Journal of Obesity*;10.1038/sj.ijo.0803774

Owen N, Humpel N, Leslie E, Bauman A & Sallis JF (2004). Understanding environmental influences on walking; Review and research agenda. *American Journal of Preventive Medicine*, 27(1):67-76.

Paffenbarger, R. S., Wing, A. L., Hyde, R. T., & Jung, D. L. (1983). Physical activity and incidence of hypertension in college alumni. *American journal of epidemiology*, *117*(3), 245-257.

Pate RR, Freedson PS & Sallis JF (2002). Compliance with physical activity guidelines: prevalence in a population of children and youth. *Annals of Epidemiol*ogy; 12:303–8

Pellegrini, A. D., Huberty, P. D., & Jones, I. (1995). The effects of recess timing on children's playground and classroom behaviors. *American Educational Research Journal*, *32*(4), 845-864.

Pellegrini, A. D., & Blatchford, P. (2002). The developmental and educational significance of recess in schools. *Early Rep*, *29*(1), 1-7.

Pellegrini, A. D., Blatchford, P., Kato, K., & Baines, E. (2004). A Short term Longitudinal Study of Children's Playground Games in Primary School: Implications for Adjustment to School and Social Adjustment in the USA and the UK. *Social Development*, *13*(1), 107-123

Physical Activity Guidelines Advisory Committee. *Physical Activity Guidelines Advisory Committee Report, 2008*. Washington, DC: U.S. Department of Health and Human Services

Playboard (2008). *The Positive Playground and Evaluation Report.* Northern Health and Social Care Trust

Powell, K. E., Thompson, P. D., Caspersen, C. J., & Kendrick, J. S. (1987). Physical activity and the incidence of coronary heart disease. *Annual review of public health*, *8*(1), 253-287.

Reilly JJ, Methven E & McDowell SC (2003). Health consequences of obesity: systematic review. *Archives of Disease in Childhood;* 88:748–52

Rice, M. H. & Howell, C. C. (2000). Measurement of physical activity, exercise, and physical fitness in children: issues and concerns. *Journal of Pediatric Nursing*, *15*(3), 148-156.

Ridgers, N. D., Stratton, G., & Fairclough, S. J. (2005). Assessing physical activity during recess using accelerometry. *Preventive medicine, 41(1), 102-107.*

Ridgers ND, Stratton G & Fairclough SJ (2006). Physical activity levels of children during school playtime*. Sports Medicine*;*36*:*359-71*

Ridgers, N. D., Stratton, G., Fairclough, S. J., & Twisk, J. W. (2007). Long-term effects of a playground markings and physical structures on children's recess physical activity levels. *Preventive medicine*, *44*(5), 393-397.

Roberts C, Tynjala J & Komkov A (2004). *Young people's health in context. Health Behaviour in School-aged Children (HBSC) study.* International report from 2001/2002 survey. Copenhagen: World Health Organization; 90–7

Ruiz JR, Rizzo NS, Hurtig-Wennlöf A, Ortega FB, Wärnberg J, Sjöström M, 2006. Relations of total physical activity and intensity to fitness and fatness in children: the European Youth Heart Study. *American Journal of Clinical Nutrition*: 84:299-303.

RTE (2005). *Hanafin bemoans school 'no running policies.'* Retrieved June 8th 2013 http://www.rte.ie/news/2005/0522/hanafinm.html

Saelens BE, Sallis JF & Frank LD (2003). Environmental correlates of walking and cycling: findings from the transportation, urban design, and planning literatures. *Annals of Behavioral Medicine*, 25(2):80-91.

Safrit, M. J. (1990). The validity and reliability of fitness tests for children: a review. *Pediatric Exercise Science*, *2*(1), 9-28.

Sallis JF & Patrick K (1994). Physical Activity Guidelines for Adolescents: Consensus Statement. *Pediatric Exercise Science*; 6(4):302-314.

Sallis JF, McKenzie TL & Alcaraz JE (1997). The effect of a 2-year physical education program (SPARK) on physical activity and fitness in elementary school students. *American Journal of Public Health*; 87:1328–34.

Sallis JF, Bauman A & Pratt M (1998). Environmental and policy interventions to promote physical activity. *American Journal of Preventive Medicine*, 15(4):379-397.

Sallis, J. F., Prochaska, J. J., & Taylor, W. C. (2000). A review of correlates of physical activity of children and adolescents. *Medicine and science in sports and exercise*, *32*(5), 963-975.

Sandercock, G., Voss, C., McConnell, D., & Rayner, P. (2010). Ten year secular declines in the cardiorespiratory fitness of affluent English children are largely independent of changes in body mass index. *Archives of disease in childhood*, *95*(1), 46-47

Sandseter, E. B. H. (2011). *A quantitative study of ECEC practitioners' views and experiences on children's risk-taking in outdoor play.* Paper accepted for the 21st EECERA conference, Education from birth: research, practices and educational policy Lausanne and Geneva, 14-17 September 2011. http://www.eecera2011.org/.

Sarkin JA, McKenzie TL & Sallis JF (1997). Gender differences in physical activity during fifth-grade physical education and recess periods. *Journal of Teaching Physical Education;17:99–106.*

Saxena, S., Van Ommeren, M., Tang, K. C., & Armstrong, T. P. (2005). Mental health benefits of physical activity. *Journal of Mental Health*, 14(5), 445-451.

Scruggs PW, Beveridge SK & Watson DL (2003). Increasing children's school time physical activity using structured fitness breaks. *Pediatric Exercise Science*;15:156–69.

Sleap M & Warburton P (1996). Physical activity levels of 5–11-year-old children in England: cumulative evidence from three direct observation studies. *International Journal of Sports Med*icine; 17:248–53.

Sleap, M., Warburton, P., & Waring, M. (2000). Couch potato kids and lazy layabouts: The role of primary schools in relation to physical activity among children. *Beyond the boundaries of physical education: Educating young people for citizenship and social responsibility*, 31-50.

Stalsberg, R., & Pedersen, A. V. (2010). Effects of socioeconomic status on the physical activity in adolescents: a systematic review of the evidence. *Scandinavian journal of medicine & science in sports*, *20*(3), 368-383.

Steindorf, K., Leitzmann, M. F., & Friedenreich, C. M. (2013). *Physical activity and primary cancer prevention. in Exercise, Energy Balance, and Cancer* (pages 83-106). Springer New York.

Stephens, T. (1988). Physical activity and mental health in the United States and Canada: evidence from four population surveys. *Preventive medicine*, *17*(1), 35-47.

Stellino MB & Sinclair CD (2008). Intrinsically motivated, free-time physical activity: Considerations for recess. *Journal of Physical Education, Recreation and Dance*; 79(4):37-40.

Story M, Kaphingst KM & French S (2006). The role of schools in obesity prevention. *Future Child; 16:109-42.*

Story, M., Nanney, M. S., & Schwartz, M. B. (2009). Schools and obesity prevention: creating school environments and policies to promote healthy eating and physical activity. *Milbank Quarterly*, *87*(1), 71-100.

Stratton G (2000). Promoting children's physical activity in primary school: an intervention study using playground markings. *Ergonomics*; 43:1538–46.

Stratton, G., & Leonard, J (2002). The effects of playground markings on the energy expenditure of 5-7-year-old school children. *Pediatric Exercise Science*, *14*(2), 170-180.

Stratton G & Mullan E (2005): The effect of multicolor playground markings on children's physical activity level during recess. *Preventive Medicine*

Sutterby J, Brown P & Thornton C (2004). *Physical activity levels during free play and physical education*. Paper presented at the Pedagogy for Learning Movement. Aera 2004

Sutherland, T. J., Cowan, J. O., Young, S., Goulding, A., Grant, A. M., Williamson, A & Taylor, D. R. (2008). The association between obesity and asthma: interactions between systemic and airway inflammation. *American journal of respiratory and critical care medicine*, *178*(5), 469-475.

Swartz MB & Puhl R (2003). Childhood obesity: a societal problem to solve. *Obesity Reviews* 4(1):57—71

Taylor ED, Theim KR & Mirch MC (2006). Orthopedic complications of overweight in children and adolescents. *Pediatrics.* 117(6):2167—2174

Taylor RW, Farmer VL, Cameron SL, Meredith-Jone K, Williams SM, Mann JI (2011). School playgrounds and physical activity policies as predictors of school and home time activity. *International Journal of Behavioral Nutrition and Physical Activity*, 8:38

Trost SG, Pate RR & Sallis JF (2002). Age and gender differences in objectively measured physical activity in youth. *Medicine and Science in Sports and Exercise*;34:350–5.

Trudeau F & Shephard R (2005). Contribution of school programmes to physical activity levels and attitudes in children and adults. *Sports Medicine;* 35*:*89-105*.*

Tudor-Locke, C., Lee, S. M., Morgan, C. F., Beighle, A., & Pangrazi, R. P. (2006). Children's pedometer-determined physical activity during the segmented school day. *Medicine and science in sports and exercise*, *38*(10), 1732.

Twisk JW, Kemper HC & van Mechelen W (2000). Tracking of activity and fitness and the relationship with cardiovascular disease risk factors. *Medicine & Science in Sports & Exercise*; 32:1455-61.

Uebelacker L.A, Eaton CB, Weisberg R, Sands M, Williams C, Calhoun D & Taylor T (2013). Social support and physical activity as moderators of life stress in predicting baseline depression and change in depression over time in the Women's Health Initiative. *Social psychiatry and psychiatric epidemiology*, 1-12.
US Department of Health and Human Services (2008). *2008 Physical Activity Guidelines for Americans*. Washington DC.

US Department of Health and Human Services (2010). *The Surgeon General's vision for a healthy and fit nation*.
http://www.surgeongeneral.gov/library/obesityvision/obesityvision2010.pdf..

UK Department of Health, Physical Activity, Health Improvement and Protection (2011). *Start Active, Stay Active: A Report on Physical Activity from the Four Home Countries'*; Chief Medical Officers, Department of Health, London, UK

Van Lenthe, F. J., Kemper, C. G., & van Mechelen, W. (1996). Rapid maturation in adolescence results in greater obesity in adulthood: the Amsterdam Growth and Health Study. *The American journal of clinical nutrition*, *64*(1), 18-24.

Waring, M., Warburton, P., & Coy, M. (2007). Observation of children's physical activity levels in primary school: Is the school an ideal setting for meeting government activity targets? *European Physical Education Review*, *13*(1), 25-40

Wechsler H, Devereaux RS, Davis M & Collins J (2000). Using the school environment to promote physical activity and healthy eating. *Preventive Medicine*; 31:121S–37S

Welk GJ & Blair SN (2008). Health benefits of physical activity and fitness in children. In: Welk GJ, Meredith MD, eds. Fitnessgram/Activitygram Reference Guide. 3rd ed. Dallas, TX: *The Cooper Institute*; pp. 4(2)–4(12).

Whitlock EP, Williams SB, Gold R, Smith PR & Shipman SA (2005). Screening and interventions for childhood overweight: a summary of evidence for the US Preventive Services Task Force. *Pediatrics.* 116(1):e125—144

Woods C, Nelson N, O'Gorman D & Moyna N (2007). *The Take Part Study, Physical Activity Research for Teenagers, A Report for the Midlands Area*, School of Health and Human Performance, Dublin City University.

Woods CB, Tannehill D, Quinaln A, Moyna N & Walsh J (2010). *The Children's Sport Participation and Physical Activity Study (CSPPA)*. School of Health and Human Performance, Dublin City University and the Irish Sports Council, Dublin, Ireland.

World Health Organization (2006). *Physical activity and health in Europe: Evidence for Action*. Publications, WHO Regional Offices for Europe, Denmark.

World Health Organization (2010). *Childhood Overweight and Obesity on the Rise*. World Health Organization, Geneva, Switzerland.

World Health Organization. (2010). *Global recommendations on physical activity for health*. Geneva: World Health Organization, 8-10.

World Health Organization (2011). *Global status report on non-communicable diseases 2010*. World Health Organization, Geneva, Switzerland

World Heath Organisation (2012). *Global Strategy on Diet, Physical Activity and Health-Childhood Overweight and Obesity.*
http://www.who.int/dietphysicalactivity/childhood/en/

Zask, A., van Beurden, E., Barnett, L. M., Brooks, L. O., & Dietrich, U. C. (2001). Active school playgrounds-myth or reality? Results of the 'Move It Groove It' project. *Preventive medicine*, *33*(5), 402-408.

Chapter 2: Research Project

Title:
Evaluation of children's fitness levels across the first year of primary school

Word count: 4,411

Key words: children; school break-time; playground; fitness

Appropriate journal for publication of this research project

The journal, *Pediatric Exercise Science*, would be a suitable choice for the inclusion of this research project. This project focuses on the role of a school playground intervention on children's fitness levels over the first year of primary school. *Pediatric Exercise Science* is appropriate to this research as it is dedicated to furthering scientific knowledge in the area of exercise during childhood, which is very applicable to this study.

Abstract

Background

Schools are seen as one of the core agents for the delivery of interventions to promote activity and combat the obesity epidemic. Research has shown that permanent playground equipment in schools can influence physical activity in children.
Few studies have examined how the physical school environment can influence fitness levels of children during break-time periods, particularly in an Irish context.

Aim

The objective of this study was to evaluate the effect of fixed playground structures on children's fitness levels during the first year of primary school.

Methods

The intervention school had daily access to a fully equipped playground while the control had an equipment free play area. The EUROFIT test battery consisted of five tests items measuring aerobic capacity, muscular strength, muscular endurance and flexibility. The test items were the 10x5 metre shuttle run, sit and reach test, simple standing balance test, bent arm hang and sit-up test.

Results

Results showed an increased level of physical fitness in the intervention school in the sit-up test ($F(1, 44) = 38.75$, $p < 0.0001$), balance test ($F(1, 44) = 44.03$, $p < 0.0001$) and shuttle run test ($F(1, 44) = 18.82$, $p < 0.0001$). No significant difference between schools was seen in the sit and reach flexibility test ($F(1, 44) = 2.23$, $p > 0.05$) and bent arm hang test ($F(1, 44) = 0.00$, $p > 0.05$). Yet a significant interaction was detected between time and school type in both the sit and reach test ($F(2.21, 97.19) = 71.21$, $p < 0.0001$) and bent arm hang test ($F(2.03, 89.05) = 25.31$, $p < 0.0001$).

Conclusion

Providing permanent playground equipment in school was found to be effective in increasing fitness levels in primary school children aged 5-6 years.

2.1 Introduction

Schools have been acknowledged by international and national policy as being a key setting for the promotion of physical activity (PA) in children (Layte & McCrory, 2011; WHO, 2010). The annual requirement of attendance for children in Irish Primary Schools is 183 days (Department of Education and Skills, 2012). As a result schools are seen as key settings to promote physical activity and cardiovascular fitness (Tudor-Locke, Lee, Morgan, Beighle, & Pangrazi, 2006). The school environment can provide ample opportunity for children to be physically active, including physical education (PE) lessons and break-times.

Many intervention studies have found that PE class fails to supply adequate activity to help children meet the recommendation of 60 minutes or more of moderate to vigorous physical activity on five or more days per week (Friedman, Belsky & Booth, 2003; McKenzie, Marshall, Sallis & Conway, 2000). As curriculum time scheduled for PE is limited (60 minutes weekly), break-time (40 minutes daily) is a key opportunity for the promotion of PA.

Consequently, the break-time environment should promote PA in children. Relatively positive benefits have been shown by adapting playgrounds and installing fixed playground equipment and playground markings to encourage more PA in children at primary school (Farley, Meriwether, Baker, Rice & Webber, 2008; Ridgers, Stratton, Fairclough & Twisk, 2007; Sutterby, Brown & Thornton, 2004). Little research has been

carried out on the impact of permanent playground equipment on physical fitness in children during break-time. To date there seems to have been no Irish study, and very few international studies, that have investigated the influence of fixed playground equipment at break-time on children's fitness levels.

Aim

The aim of this study was to evaluate and compare fitness levels of primary school children (aged 5-6 years) during the first year of primary school that had regular access to permanent playground equipment and compare them to children of similar age with an equipment free school play area.

2.2 Methodology

Participants and Settings

The research project was executed in the east of Ireland from September 2012 to June 2013 inclusive. Two primary schools participated in the project. School A had daily access to a fully equipped playground (intervention group) while school B had an equipment free play area (control group). School A's fully equipped playground (see Figure 1) was built in the summer of 2012. The children participating in the study were aged 5 to 6 years and had never used the equipment prior to commencing school on September 3rd 2013. It consisted of one large swing, two slides, monkeys bars, balance beams, hanging bars of various sizes, see-saw and merry-go-round, all of which was stated as being a 'rare commodity' in Irish schools (Marron, 2008). The cost of the

playground to the school was €85,000. No published data on the number of schools in Ireland with fixed playground equipment was available at the time of print. Yet in one Irish study analyzing break-time play in 391 Irish Primary Schools, fixed playground equipment in schools was defined as 'scarce and basic' (Marron, 2008). School B had an equipment free play area (see Figure 1).

School A's play area

School B's play area

<u>Figure 1</u>: Fixed Playground Equipment (School A) versus Equipment-free play area (School B)

Information relating to break-time characteristics in the two observed schools are reviewed in Table 4. This comprises of the activities observed during break-time, the equipment available, type of yard surface as well as games observed. Neither school had a school policy on break-time play. Break-time duration was forty minutes daily in both schools. Lunch was eaten prior to break-time.

Table 4: Break-time related characteristics of the two observed schools

Characteristics	School A	School B
Enrolment for 2013-2014 academic year	442	398
Description of school play area	Fully equipped playground consisting of one large swing, two slides, monkey bars, balance beams, hanging bars of three varying sizes (600 cm, 1 metre, 1.5 metres), see-saw and merry-go-round.	Equipment free schoolyard space.
School yard surface	Rubber playground surfacing	Tarmacadam surface
Equipment available at break time	Fixed playground equipment	No equipment provided
Break time policy when it is raining	Sedentary play with games in their classroom.	Sedentary play with games in their classroom.
Dress code	School uniform consisted of a navy and green tracksuit and black/navy running shoes.	School uniform consisted of a navy tracksuit with black/navy running shoes.
Games observed	Climbing and hanging games; travelling under, over and through apparatus; chasing games; engaging in play on the see-saw, merry-go-round, swings and slide; running races.	Chasing games; running races; cartwheels and handstands; clapping games.

The participating schools were neighbouring schools within 500 metres of each other, with similar socio-economic backgrounds and comparable access to sports and or facilities locally. The study population included fifty 5-6 year old children from the two observed schools. During the collection of data, four children from school B were excluded from further analyses due to sickness on the days of measurement. As a result, a sample of forty six children was evaluated (n=46). The intervention group (school A)

consisted of 27 children (13 girls and 14 boys, mean age: 5.7 ± 0.6 years). The control group (school B) consisted of 19 children (9 boys, 11 girls, mean age: 5.8 ± 0.7 years). In both groups the children were supervised during free play but no coordinated activities were conducted at break time during the intervention. The evaluation was considered to be part of the physical education programme provided by the schools for which all parents signed a consent form. The research in both schools was carried out by the author, who was also the class teacher for the participants from the intervention school A. The study protocol was approved by the Research Ethics Committee of the Faculty of Applied Sciences of the University of Chester (see Appendix 1).

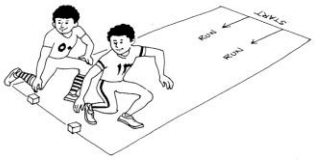
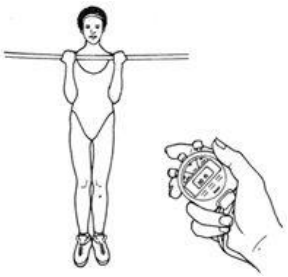
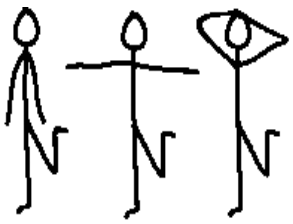
2.4 Procedure

Test Items

The EUROFIT fitness test (Council of Europe, 1993) was selected as the most applicable to this age group (Fjørtoft, 2000; Fjørtoft, Pedersen, Sigmundsson & Vereihken, 2011). From the literature reviewed on children's fitness testing, the EUROFIT motor fitness test (Council of Europe, 1993) is for the 5-7 year old children with very slight modifications recommended (Fjørtoft, 2000). Throughout this model compound activities are targeted, for example endurance, running speed, agility, strength, balance and flexibility (Fjørtoft, 2000; Fjørtoft, et al. 2011; Haga, 2008; Haga, 2009). Familiar pursuits that children engage in during play are focused on, ensuring cognitive understanding. For the purpose of this study and the age-group being tested, static

balance will be assessed using the Standing Balance test as recommended by Clark and Watson (1984), as the reproducibility was rated low on EUROFIT's Flamingo Balance test for the 5-7 year old age group (Fjørtoft, 2000). The sit and reach test measures flexibility. Strength is tested by the bent arm hang test and the sit-up test. Running speed and agility is tested by a 10x5 metre shuttle run (Council of Europe, 1993). See Table 5.

Table 5: Details of fitness tests used in the study (based on the EUROFIT model)

Fitness Test	Aim	Procedure
10x5 metre shuttle run 	This test measures speed and agility.	The test records the amount of time required to run 10x5 metres (measured in seconds).
Sit and Reach Test 	The sit and reach test assesses flexibility.	This assessment involves the participant sitting on the floor with both knees locked out and the soles of the feet positioned flat against the box. The participant then stretches forward down the measuring line with their palm faced downwards and hands positioned side by side. The distance is then documented.
Bent Arm Hang 	The bent arm hang test measures upper body strength and endurance.	The participant is helped into position in order for their chin to be equal with the horizontal bar. The hands are in an overhand grip and shoulder width apart. The participant is timed from when they are released. The stopwatch is stopped when the chin falls below the height of the horizontal bar.
Standing Balance Test 	This balance test measures balance levels.	The participant stands on one leg for as long as possible. The stopwatch is halted as soon as the raised foot reached the ground or the participant loses their balance position.

Sit-up test 	This test was used to measure the endurance of the abdominal and hip-flexor muscles.	The participant executes as many sit-ups as possible in thirty seconds. They are instructed to lie on the mat with feet flat on the floor, knees bent at right angles, and fingers interlocked behind the head. When directed they elevate the chest so that the upper body is vertical and then return to the mat.

The fitness tests were carried out by the author on the participating children four times from September 2012 to June 2013, as follows:

- 4th of September 2012 – Start of term one.
- 8th of January 2013 – Start of term two.
- 8th of April 2013 – Start of term three.
- 27th of June 2013 – End of academic year.

Each test was carried out individually on the children after a general warm-up. Warming up is essential in preparing the body appropriately for involvement in exercise (Government of Ireland, 1999). The warm-ups during the course of this study were consistent prior to each administered test and involved a gentle jog followed by mobility and stretching exercises. The course of fitness assessments were carried out in school A and school B's respective school gymnasiums, so weather was not a factor in collecting the data. Each assessment was allotted a clearly marked zone. Clear instructions and

demonstrations were given on each test item prior to commencement. All tests were carried out twice with the greater attempt recorded. If a technical error was made, the child made another attempt after the test item was re-explained and demonstrations were shown again. Data was recorded on Microsoft Excel after each procedure.

2.5 Data Analysis and Results

All data was analysed using SPSS (19.0). The analyses contain five 4 x 2 mixed design factorial ANOVAs within-subjects/repeated-measures effects (Time 1, Time 2, Time 3 and Time 4) and between-subject effects (school A and school B).

Shuttle Run Test

Table 6 shows the results of the 10x5 metre shuttle run test which measures speed and agility.

Table 6: Shuttle run fitness test results: Mean times +/- standard deviation (SD) for 10x5 metre shuttle run fitness test (measured in seconds)

Date of measurement	School A (seconds)	School B (seconds)
Time 1: 4.9.2012	140 +/ -40 seconds	138 +/ -39 seconds
Time 2: 8.1.2013	89+/ -29 seconds	127+/ -43 seconds
Time 3: 8.4.2013	56+/ -29 seconds	110+/ -42 seconds
Time 4: 27.6.2013	19+/ -13 seconds	91+/ -38 seconds

Participants from school A with fixed playground equipment had significantly faster times than children in school B. A significant effect of the school type also was seen, $F(1, 44) = 18.82$, $p < 0.0001$. There was a significant interaction between time and school type (see Figure 2.1) also detected, $F(2.35, 103.48) = 37.23$, $p < 0.0001$.

Additionally, the results show a noticeable improvement in the speed and agility participant's from school A over the ten month study. There was a significant effect of time points (Time 1, Time 2, Time 3 and Time 4) on the 10x5 metre shuttle run scores, $F(2.35, 103.48) = 194.22$, $p < 0.0001$. Mean scores of the 10x5 metre shuttle run results systematically decreased over time in both groups (see Table 6).

Table 6 and the interaction graphs (see Figure 2.2) show that mean times are very similar at Time 1 (school A: 140 SD +/ -40 seconds; school B: 138 SD+/ -39 seconds), but that at Times 2, 3 and 4 there is a clear effect and significant difference of school type on the obtained results. At Time 2 there is a mean difference of 38 seconds (SD +/- 36 seconds) between the schools (school A: 89 SD+/ -29 seconds; school B: 127 SD+/ -43 seconds). Consistently, increases were seen in Time 3 and 4 between the schools. There was a mean difference of 54 seconds (SD +/ 36 seconds) at Time 3 and 72 seconds (SD +/- 26 seconds) at Time 4 between the schools, with school A again scoring lower than school B. This verifying the increase in speed and agility in school A compared to school B throughout the course of the study.

Sit and Reach Test

The results of the sit and reach scores improved over the ten month study in both schools (see Table 7), yet no significant difference between schools was detected ($F(1, 44) = 2.23$, $p > 0.05$). There was no significant interaction between time and school type either (see Figure 3.2), $F(2.21, 97.19) = 0.91$, $p > 0.05$.

Table 7: Sit and Reach fitness tests results: Mean scores +/- standard deviation for sit and reach fitness test (measured in centimetres)

Date of measurement	School A (centimetres)	School B (centimetres)
Time 1: 4.9.2012	83+/ -55 centimetres	64+/ -49 centimetres
Time 2: 8.1.2013	96+/ -53 centimetres	75+/ -48 centimetres
Time 3: 8.4.2013	106+/ -53 centimetres	83+/ -48 centimetres
Time 4: 27.6.2013	122+/ -50 centimetres	96+/ -49 centimetres

A significant effect of time points (Time 1, Time 2, Time 3 and Time 4) on sit and reach scores was detected, $F(2.21, 97.19) = 71.21$, $p < 0.0001$. Mean scores of sit and reach results systematically increased over time in both groups (see Table 7). At Time 1 there was a mean difference of 19 centimetres (SD +/- 52 centimetres) between the schools (school A: 83 SD+/ -55 centimetres; school B: 64 SD+/ -49 centimetres). A mean difference at Time 4 of 26 centimetres (SD +/- 50 cm) existed between the schools at the end of the intervention, with school A having greater flexibility results than school B.

Bent Arm Hang Test

There was no significant difference between school A and B (see Figure 4.1) in terms of strength as measured by the Bent Arm Hang test ($F(1, 44) = 0.00$, $p > 0.05$). There was a noticeable increase in children's strength, however, in both schools over the course of the ten month study (see Table 8). A significant interaction between time and school type (see Figure 4.2) was detected, $F(2.03, 89.05) = 25.31$, $p < 0.0001$.

Table 8: Bent Arm Hang test results: **Mean scores +/- standard deviation for bent arm hang fitness test (measured in seconds)**

Date of measurement	School A (seconds)	School B (seconds)
Time 1: 4.9.2012	52+/ -51 seconds	83+/ -54 seconds
Time 2: 8.1.2013	85+/ -54 seconds	92+/ -50 seconds
Time 3: 8.4.2013	106+/ -51 seconds	93+/ -48 seconds
Time 4: 27.6.2013	126+/ -44 seconds	102+/ -42 seconds

A significant effect of time points (Time 1, Time 2, Time 3 and Time 4) was also seen on Bent Arm Hang scores, $F(2.03, 89.05) = 66.16$, $p < 0.0001$. Mean scores of Bent Arm Hang results systematically increased over time in school A (see Table 8). A mean difference of 74 seconds (SD +/-48 seconds) existed between Time 1 (mean: 52 SD+/ -51 seconds) and Time 4 (mean: 126 SD+/ -44 seconds) in school A, showing the increase in children's strength after the intervention. In school B there was also a visible increase between times, but not to the same extent as school A. Time 1 (mean=83 SD+/ -54

seconds), Time 2 (mean=92 SD+/ -50 seconds), Time 3 (mean=93 SD+/ -48 seconds) and Time 4 (mean=102 SD+/ -42 seconds) all showed improvements in strength over the course of the study.

Standing Balance Test

There was a significant difference in results on balance levels between school A and B over the ten month study, as measured by the standing balance test (see Table 9).

Table 9: Standing Balance Test Results: Mean scores and standard deviation for standing balance test (measured in seconds)

Date of measurement	School A (seconds)	School B (seconds)
Time 1: 4.9.2012	97+/ -42 seconds	38+/ -30 seconds
Time 2: 8.1.2013	113+/ -40 seconds	45+/ -35 seconds
Time 3: 8.4.2013	128+/ -39 seconds	57+/ -36 seconds
Time 4: 27.6.2013	150+/ -36 seconds	63+/ -34 seconds

A significant effect of time points (Time 1, Time 2, Time 3 and Time 4) on the standing balance scores was also detected, $F(2.15, 94.5) = 128.01$, $p < 0.0001$. A significant interaction between time and school type was also identified, $F(2.15, 94.5) = 15.14$, $p < 0.0001$.

Mean scores in school A were noticeably higher (Time 1: mean 97 SD+/ -42 seconds) than school B (Time 1: mean 38 SD+/ -30 seconds) at the beginning of the intervention.

Mean scores of the standing balance results systematically increased (see Table 9) over time in both groups, although the slope of the line is noticeably flatter in school B (see Figure 5.1). The difference in the slopes is further supported by in the fact that a significant effect of the school type (see Figure 5.2) was detected, $F(1, 44) = 44.03$, $p < 0.0001$.

A mean difference of 53 seconds (SD +/- 39 seconds) existed between Time 1 (mean: 97 SD+/ -42 seconds) and Time 4 (mean: 150 SD+/ -36 seconds) in school A, showing a significant increase in balance after the intervention. Less of a significant mean difference (25 seconds SD +/- 32 seconds) existed between Time 1 (mean: 38 SD+/ -30 seconds) and Time 4 (mean 63 SD+/ -34 seconds) in control school B. There was a mean difference of 87 seconds (SD +/- 35 seconds) in Time 4 between school A (mean: 150 SD+/ -36 seconds) and B (mean: 63 SD+/ -34 seconds), showing the increased balance levels of participant's from the intervention school.

Sit-up Test

Children in school A were able to perform significantly more sit-ups than their counterparts in school B (see Table 10). School A also had a higher level of improvement in this test over the ten month study.

<u>Table 10</u>: Sit-up Test Results: **Mean scores and standard deviation for sit up fitness test (number executed in thirty seconds)**

Date of measurement	School A (number executed in 30 seconds)	School B (number executed in 30 seconds)
Time 1: 4.9.2012	5 +/- 3	5 +/-2
Time 2: 8.1.2013	11 +/- 3	7 +/-2
Time 3: 8.4.2013	15 +/- 3	8 +/-3
Time 4: 27.6.2013	20 +/- 3	10 +/-3

There was a significant effect of time points (Time 1, Time 2, Time 3 and Time 4) on the sit-up scores, $F(2.065, 90.86) = 235.65$, $p < 0.0001$. Mean scores of the sit-up results systematically increased (see Table 10) over time in both groups, although the slope of the line is noticeably flatter in school B (see Figure 6.1). The difference in the slopes is supported by in the fact that a significant effect of the school type (see Figure 6.2) was detected, $F(1, 44) = 38.75$, $p < 0.0001$. Additionally, a significant interaction between time and school type was also identified, $F(2.065, 90.86) = 42.13$, $p < 0.0001$.

A mean difference of 15 sit-ups completed in 30 seconds (SD +/-3) existed between Time 1 (mean: 5 sit-ups/30 seconds SD+/-3) and Time 4 (mean: 20 sit-ups/30 seconds SD +/-3) in school A. Less of a significant mean difference (5 sit-ups/30 seconds SD +/-3) occurred between Time 1 (mean: 5 sit-ups/30 seconds SD +/- 2) and Time 4 (mean: 10 sit-ups/30 seconds SD +/-3) in the control school B. A mean difference of 10 sit-ups/30 seconds (SD +/-3) occurred in Time 4 between school A (mean: 20 sit-ups/30 seconds SD

+/-3) and B (mean: 10 sit-ups/30 seconds SD +/-3) after the intervention. This verifying the increase in endurance of the abdominal and hip-flexor muscles in school A compared to school B after the ten month study.

2.6 Discussion

World Health Organisation (WHO, 2004) stresses the importance of playground facilities for the promotion of PA and fitness in schools. The aim of this study was to evaluate the effect of fixed playground facilities on children's fitness levels during the first year of primary school.

In this study, the presence of fixed playground equipment had a significant effect on the fitness levels of children in three of the five EUROFIT fitness tests assessed in the areas of endurance (sit-up test: $F(1, 44) = 38.75$, $p < 0.0001$), balance (standing balance test: $F(1, 44) = 44.03$, $p < 0.0001$), speed and agility (shuttle run test: $F(1, 44) = 18.82$, $p < 0.0001$). In these three tests, school A (intervention) performed statistically better than school B (control) over the course of the ten month study. There was no significant difference between schools in the sit and reach flexibility test ($F(1, 44) = 2.23$, $p > 0.05$). Additionally no significant difference between schools was seen in the bent arm hang test ($F(1, 44) = 0.00$, $p > 0.05$), which measured children's strength and endurance. Yet a significant interaction was detected between time points and school type in both the sit and reach test ($F(2.21, 97.19) = 71.21$, $p < 0.0001$) and bent arm hang test ($F(2.03, 89.05) = 25.31$, $p < 0.0001$). This indicates that an increase occurred in participant's

flexibility (see Table 7), strength and endurance (see Table 8) over the ten month study, which were both highlighted to be more significant in the intervention school.

There was a significant difference in children's individual times and scores in all five fitness tests throughout the ten month study. Improvements were seen in most participants from both the control and intervention schools. Improvements were particularly apparent in the shuttle-run test (mean difference between school A and B in Time 4: 72 seconds SD +/-26 seconds) and the balance test (mean difference between school A and B in Time 4: 87 seconds SD +/- 35 seconds). This may be due to the age group being tested (5-6 years) as research has shown that younger children can have a greater biological instinct to be physically active (Rowland, 1998). McKenzie, Sallis and Elder (1997) found that children (n=287; mean age of 6.6 years) engaged in moderate to vigorous physical activity (MVPA) 48% of break-time when equipment was in place in the school playground. This percentage is more favourable than the threshold of 40% MVPA during break-time, which is advocated for health benefits in children (Stratton, et al. 2005).

The improvement in children's fitness levels from data collected is also a positive finding in regards to the intervention school. Recent research has suggested that playground equipment has a convincing effect on children's activity and fitness levels, but a decrease can be seen on the effects after six months (Ridgers, et al. 2010). This was not the case in this study.

The results are consistent with previous research advocating that developing the physical school environment can increase physical activity participation during break-time (Jago & Baranowski, 2004; Sallis, Bauman & Pratt; Story, Nanney, & Schwartz, 2009; Stratton & Mullan, 2005). However most of these studies concentrate on the equipment's effects on children's physical activity levels and do not focus on fitness, which was the aim of this study. Research has suggested that physical fitness rather physical activity is a more satisfactory predictor of health outcomes (Blair, Cheng & Holder, 2001). Data collected from an extensive study proposed that increasing physical activity is deficient as the risk of cardiovascular disease is more reliant on physical fitness instead of how much physical activity is performed (García-Artero, Ortega, Ruiz, Mesa, Delgado & González-Gross, 2007). Further studies are needed on the intensity, duration and frequency of physical activity needed to elevate fitness to a favourable level in children, which can help alleviate health risks later in life, such as obesity, diabetes, cardiovascular disease, osteoporosis and cancer (Blair, et al. 2001).

Assessment of one play area in New Orleans demonstrated that children were between 3.3 to 12.6 times more likely to be active in equipped play areas compared to equipment free areas (Farley, et al. 2008). Additionally the amount of permanent play facilities in school playgrounds were associated with a higher PA level (3.2%) in 5-12 year old children (n=441) compared with equipment free playgrounds in a New Zealand study (Taylor, Farmer, Cameron, Meredith-Jones, Williams & Mann, 2011). Fixed playground equipment in school in an American study by Sutterby, Brown and Thornton

(2004) resulted in a significant increase in children's (n=120) heart rates in comparison with heart rate levels of children in equipment free play areas. Across all age groups in the school with fixed equipment, elevated heart rates in the children were found during break-time, highlighting the positive effect of playground equipment on activity levels.

Limitations

There are several limitations of this study that should be noted. A small sample size (n=46) was investigated. The influence of teacher's encouragement on the children's use of playground facilities was not examined. Research has shown that children respond favourably to encouragement and support from teachers and other adults (McKenzie, et al. 1997). Further studies are required. The relationship between participant's BMI, body composition and their effect on fitness levels recorded was not investigated. Body composition and BMI have been related to physical fitness in children (Hussey, Bell, Bennett, O'Dwyer, & Gormley, 2007) and this warrants further research.

2.7 Conclusion

Childhood obesity has emerged as one of the most public health challenges of the twenty-first century (WHO, 2004). Schools are seen as one of the core agents for the delivery of interventions to promote physical activity and fitness, and combat the obesity epidemic (Story, Nanney & Schwartz, 2009). The results from this study show that fixed playground equipment had a significant effect on children's fitness levels in the areas of endurance, balance, speed and agility. There was no statistical data available at the time of print on the number of schools with fixed playground equipment in Ireland but evidence would suggest that school A, with a fully equipped playground, is in the minority.

Permanent play equipment and facilities in school playgrounds are associated with an elevated level of both PA and fitness in children, as shown by this study. With a recent extensive Irish study (Layte, et al. 2011) revealing that only 25% of children (n=8,568) met the recommendation of sixty minutes of moderate to vigorous physical activity per day, promotion of PA and fitness in schools along with investment in these areas are urgently required. Break-time, with an allotted 40 minutes per school day, is a key period to target. Whether altering school playground environments is an affordable and feasible option in the promotion of physical fitness and activity in children is yet to be established. Yet can we afford not to intervene and invest?

2.8 References

Blair SN, Cheng Y & Holder JS (2001). Is physical activity or physical fitness more important in defining health benefits? *Medicine & Science in Sports & Exercise;* 33:S379-99.

Council of Europe. Committee for the development of sport. Committee of experts on sports research. (1993). *EUROFIT: Handbook for the EUROFIT Tests of Physical Fitness*. Council of Europe.

Farley, T. A., Meriwether, R. A., Baker, E. T., Rice, J. C., & Webber, L. S. (2008). Where do the children play? The influence of playground equipment on physical activity of children in free play. *Journal of physical activity & health*, *5*(2), 319.

Fjørtoft, I. (2000). Motor fitness in pre-primary school children: The EUROFIT motor fitness test explored on 5-7-year-old children. *Pediatric Exercise Science*, *12*(4), 424-436.

Fjørtoft, I., Pedersen, A. V., Sigmundsson, H., & Vereijken, B. (2011). Measuring physical fitness in children who are 5 to 12 years old with a test battery that is functional and easy to administer. *Physical Therapy*, 91(7), 1087-1095.

García-Artero E, Ortega FB, Ruiz JR, Mesa JL, Delgado M & González-Gross M (2007). Lipid and Metabolic Profiles in Adolescents Are Affected More by Physical Fitness Than Physical Activity (AVENA Study). *Revista Española de Cardiología (English Version)*; 60:581-8.

Government of Ireland (1999). *Physical education curriculum*. Dublin: The Stationery Office

Haga, M. (2008). The relationship between physical fitness and motor competence in children. *Child: care, health and development*, *34*(3), 329-334.

Haga, M. (2009). Physical fitness in children with high motor competence is different from that in children with low motor competence. *Physical Therapy*, *89*(10), 1089-1097.

Hussey, J., Bell, C., Bennett, K., O'Dwyer, J., & Gormley, J. (2007). Relationship between the intensity of physical activity, inactivity, cardiorespiratory fitness and body composition in 7–10-year-old Dublin children. *British journal of sports medicine, 41(5), 311-316.*

Jago, R. & Baranowski, T. (2004). Non-curricular approaches for increasing physical activity in youth: a review. *Preventive Medicine*; 39:157–63.

Layte, R. & McCrory, C. (2011). *Growing up in Ireland: National longitudinal study of Children*. Dublin: Department of Children and Youth Affairs.

Marron, S. (2008). *An analysis of break time active play in Irish primary schools* (Doctoral dissertation, Waterford Institute of Technology).

McKenzie TL, Sallis JF & Elder JP (1997). Physical activity levels and prompts in young children at recess: a two-year study of a bi-ethnic sample. *Research Quarterly for Exercise and Sport*; 68:195–202.

McKenzie TL, Marshall SJ, Sallis JF& Conway TL (2000). Student activity levels, lesson context, and teacher behavior during middle school physical education. *Research Quarterly for Exercise and Sport;71:249–59.*

National Taskforce on Obesity (2005) *Obesity, The Policy Challenges*. Department of Health and Children, Dublin, Ireland. Accessed on July 1st 2013: http://www.dohc.ie/publications/pdf/report_taskforce_on_obesity.pdf

Ridgers, N. D., Stratton, G., Fairclough, S. J., & Twisk, J. W. (2007). Long-term effects of a playground markings and physical structures on children's recess physical activity levels. *Preventive medicine*, *44*(5), 393-397.

Ridgers ND, Fairclough, SJ, Stratton, G. (2010). 12-month effects of a playground intervention on children's morning and lunchtime recess physical activity levels. *Journal of Physical Activity and Health, 7:167-175.*

Rowland, T. (1998).The biological basis of physical activity. *Medicine & Science in Sports & Exercise; 30:392-9.*

Sallis JF, Bauman A & Pratt M (1998). Environmental and policy interventions to promote physical activity. *American Journal of Preventive Medicine*, 15(4):379-397.

Saxena, S., Van Ommeren, M., Tang, K. C., & Armstrong, T. P. (2005). Mental health benefits of physical activity. *Journal of Mental Health*, 14(5), 445-451.

Story, M., Nanney, M. S., & Schwartz, M. B. (2009). Schools and obesity prevention: creating school environments and policies to promote healthy eating and physical activity. *Milbank Quarterly*, *87*(1), 71-100.

Stratton G & Mullan E (2005): The effect of multicolor playground markings on children's physical activity level during recess. *Preventive Medicine*

Sutterby J, Brown P & Thornton C (2004). *Physical activity levels during free play and physical education*. Paper presented at the Pedagogy for Learning Movement. Aera 2004

Taylor, R. W., Farmer, V. L., Cameron, S. L., Meredith-Jones, K., Williams, S. M., & Mann, J. I. (2011). School playgrounds and physical activity policies as predictors of school and home time activity. *International journal of behavioral nutrition and physical activity*, *8*(1), 38.

Tudor-Locke, C., Lee, S. M., Morgan, C. F., Beighle, A., & Pangrazi, R. P. (2006). Children's pedometer-determined physical activity during the segmented school day. *Medicine and science in sports and exercise*, *38*(10), 1732.

US Department of Health and Human Services (2010). *The Surgeon General's vision for a healthy and fit nation*.
http://www.surgeongeneral.gov/library/obesityvision/obesityvision2010.pdf.

Waring, M., Warburton, P., & Coy, M. (2007). Observation of children's physical activity levels in primary school: Is the school an ideal setting for meeting government activity targets? *European Physical Education Review*, *13*(1), 25-40

World Health Organization (2004). *Global Strategy on Diet, Physical Activity and Health.* Geneva: World Health Organization; p. 20

World Health Organization (2011). *Global status report on non-communicable diseases 2010*. World Health Organization, Geneva, Switzerland

Zask, A., van Beurden, E., Barnett, L. M., Brooks, L. O., & Dietrich, U. C. (2001). Active school playgrounds-myth or reality? Results of the 'Move It Groove It' project. *Preventive medicine*, *33*(5), 402-408.

Appendices

<u>Appendix 1</u>: Definitions relevant to the study

Obesity is usually caused by an imbalance between calories consumed and calories utilized (WHO, 2010).

Physical fitness can be defined as a characteristic that has been attained in the performance of physical activity, which is physical movement created by the contraction of muscle that consequently creates energy expenditure (Caspersen, Powell & Christenson, 1985).

Physical activity (PA) is any bodily movement generated by muscles that cause energy expenditure.

Break-time is a forty minutes recreational period daily for Irish primary school children. It is known as recess in the USA.

Free play is play without organised instruction where children play in the school playground during break-time supervised.

Supervised play is conducted by teachers during break-time. Their role is to make sure children are safe and respond accordingly when accidents take place. They do not play a role in organising or instructing activities.

Fixed equipment at break-time is equipment that cannot be easily repositioned e.g. swings, slide, climbing frames, balance beams, basket ball nets and goal posts.

Loose equipment are small play items used during break-time e.g. hoops, balls, frisbees and skipping ropes.

MVPA stands for moderate to vigorous physical activity.

PE stands for physical education.

<u>Appendix 2</u>: Interaction graphs of interaction between fitness test scores between school A and B and within school A and B

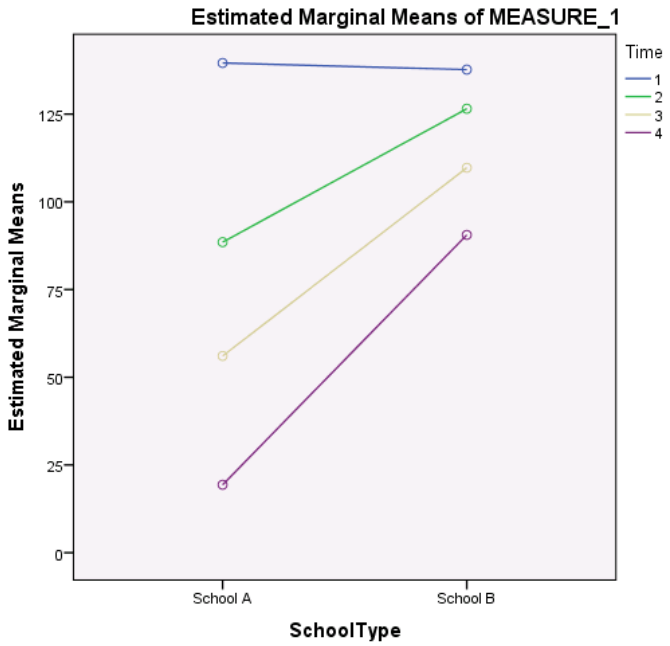


Figure 2.1 Interaction graph in shuttle run scores between school A and B

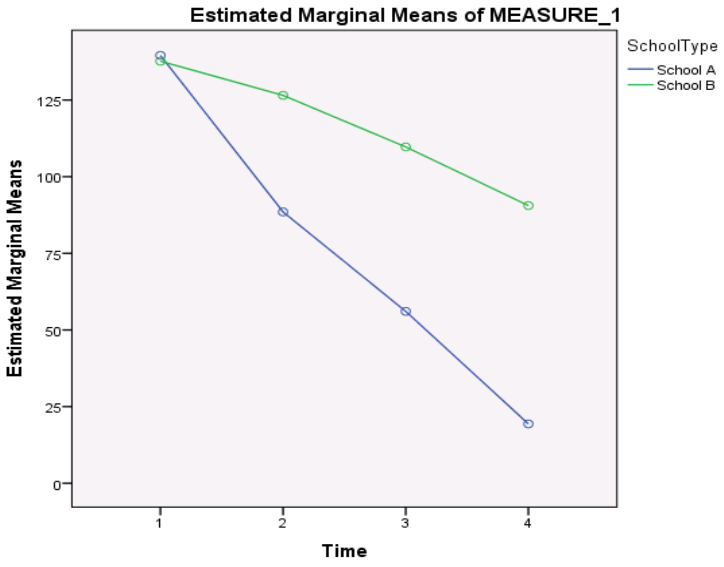


Figure 2.2 Interaction of shuttle run times within school A and B

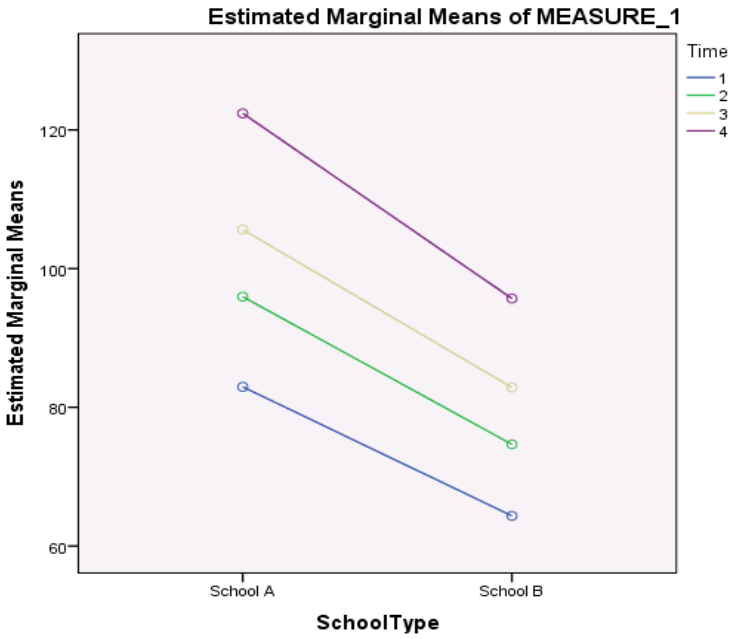


Figure 3.1 Interaction graph in sit and reach scores between school A and B

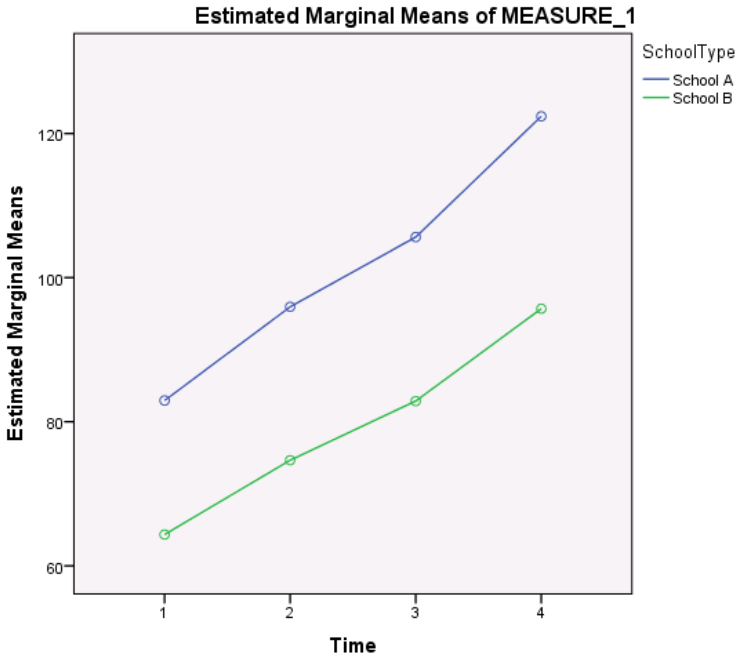


Figure 3.2 Interaction of sit and reach times within school A and B

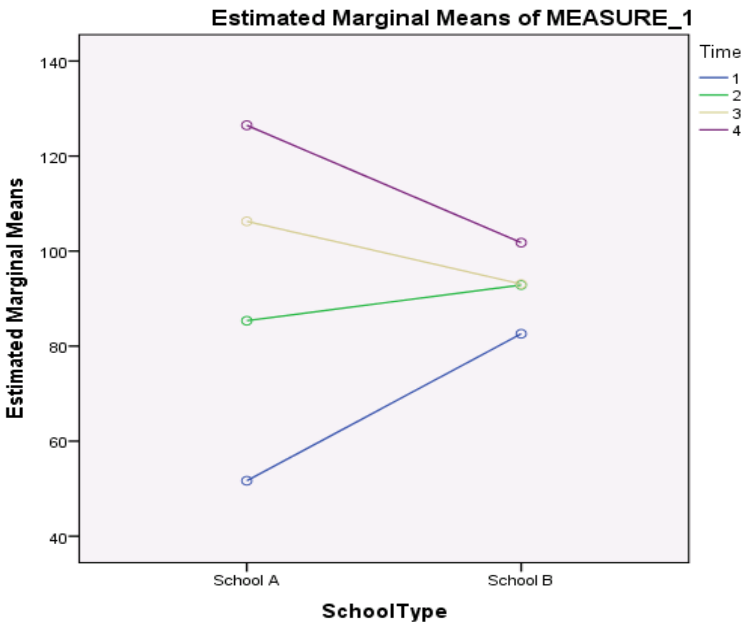


Figure 4.1 Interaction graph in bent arm hang scores between school A and B

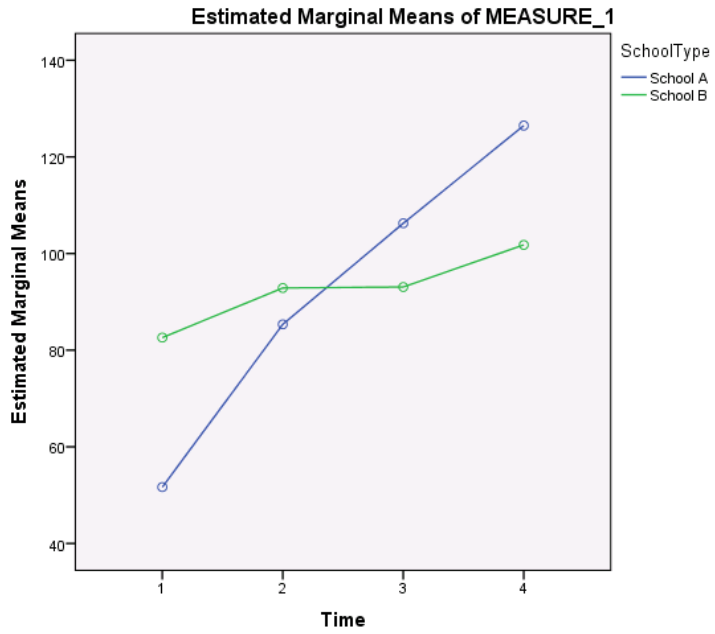


Figure 4.2 Interaction of bent arm hang times within school A and B

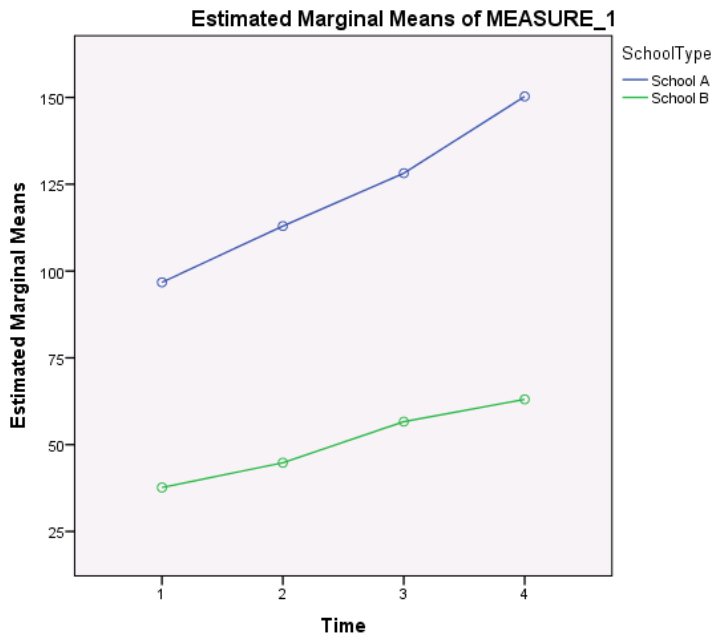


Figure 5.1 Interaction of simple standing balance test times within school A and B

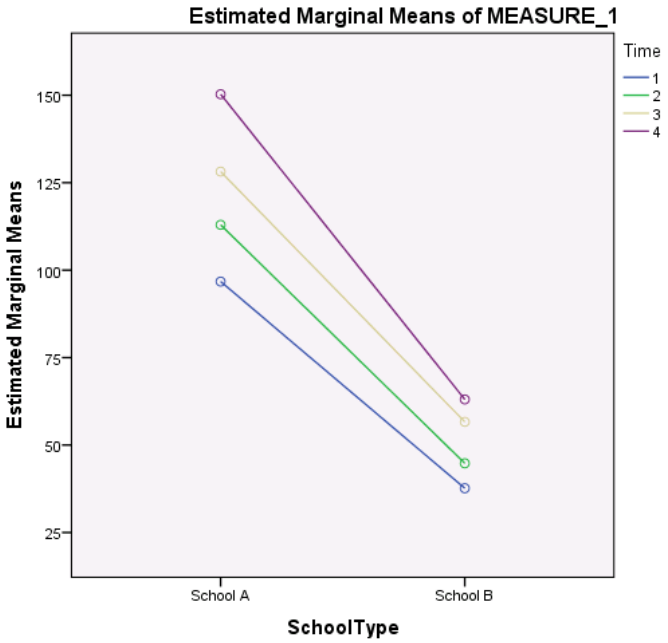


Figure 5.2 Interaction graph in simple standing test scores between school A and B

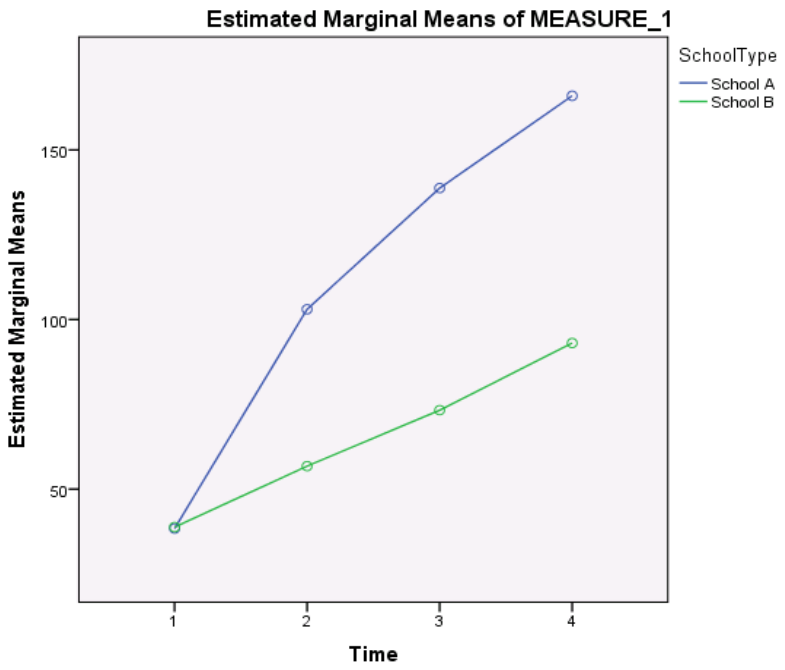


Figure 6.1 Interaction of sit up times within school A and B

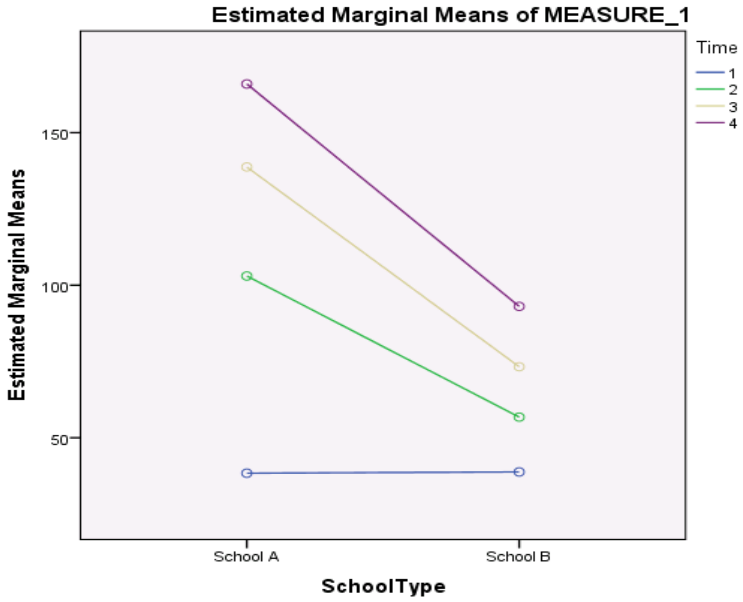


Figure 6.2 Interaction graph in sit up times between school A and B

Appendix 3: Letter of Ethical Approval

University of Chester

Faculty of Applied Sciences
Research Ethics Committee

Tel 01244 511740
Fax 01244 511302
frec@chester.ac.uk

[redacted]

12th July 2012

Dear Claire,

Study title: **Evaluation of children's fitness levels across the first year of primary school.**
FREC reference: **705/12/CH/CS**
Version number: **1**

Thank you for sending your application to the Faculty of Applied Sciences Research Ethics Committee for review.

I am pleased to confirm ethical approval for the above research, provided that you comply with the conditions set out in the attached document, and adhere to the processes described in your application form and supporting documentation.

The final list of documents reviewed and approved by the Committee is as follows:

Document	Version	Date
Application Form	1	May 2012
Appendix 1 – C.V. for Lead Researcher	1	May 2012
Appendix 2 – List of References	1	May 2012
Appendix 3 – Letters of Invitation to Parents/Guardians	1	May 2012
Appendix 4 – Participant Information Sheet	1	May 2012
Appendix 5 – Consent Forms for Parents/Guardians	1	May 2012
Appendix 6 – Written Permission – Dangan National School	1	May 2012
Appendix 7 – Risk Assessement Procedures	1	May 2012
Appendix 8 – Fitness Tests Protocol	1	May 2012
Appendix 9 – Photographs of Playground A and B	1	May 2012
Appendix 10 – Proposed Method Flow Chart	1	May 2012
Response to FREC request for further information and clarification		July 2012
Appendix 3 – Letters of Invitation to Parents/Guardians	2	July 2012
Appendix 4 – Participant Information Sheet	2	July 2012
Appendix 10 – Proposed Method Flow Chart	2	July 2012
Appendix 4 – Questions to determine children's enjoyment of the outdoor play area.	1	July 2012

With the Committee's best wishes for the success of this project.

Yours sincerely,

Dr. Stephen Fallows
Acting Chair, Faculty Research Ethics Committee

Enclosures: Standard conditions of approval.

Cc. Supervisor/FREC Representative

<u>Appendix 4</u>: Letters of invitation to parents/guardians to accompany the PIS and consent form

<u>School A</u>

Dear Parent/Guardian,

We are very proud of our new playground in St. Conleth's Infant School.

In order to show its benefit to the health and wellbeing of our pupils, I wish to measure general fitness levels of the children in First Class at the beginning of each term and the end of this school year, and find out if they have improved because of this beneficial resource. The children will get the opportunity to participate in short tests at the beginning of each school term and the end of this year, measuring balance, flexibility, endurance and strength. Each test will be administered in a safe and caring manner.

These tests will be carried out on:

- September 3rd 2012
- January 7th 2013
- April 8th 2013
- June 27th 2013

This research is being undertaken as part of my research project for a Master's in Science in Exercise and Nutrition with the University of Chester. Please feel free to ask me any questions regarding this process. Thank you for taking the time to read about the project.

Yours sincerely,

_____

Ms. Claire Heneghan

First Class Teacher

School B

Dear Parent/Guardian,

I am a teacher from St. Conleth's Infant School and I am currently studying for a Master's in Science in Exercise and Nutrition.

The health and wellbeing of the pupils in Dangan National School is paramount to children's general development. In recent years childhood obesity has become a topical issue.

I wish to measure general fitness levels of the children in First Class at the beginning of each term and the end of this school year. The children will get the opportunity to participate in short tests measuring balance, flexibility, endurance and strength.

These tests will be carried out on:

- September 3rd 2012
- January 7th 2013
- April 8th 2013
- June 27th 2013

I can be contacted at St. Conleth's Infant School on [redacted].
Thank you for taking the time to read about the project.
Yours sincerely,

_____

Ms. Claire Heneghan
First Class Teacher
St. Conleth's Infant School

Appendix 5: Participation Information Sheet

Participant information sheet

Research Project:
Evaluation of children's fitness levels across the first year of primary school

Your child has the opportunity to take part in a research study. Before you decide to give consent, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with me if you wish. Please ask if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish your child to take part.

What is the purpose of the study?
This research is being undertaken on first class children in St. Conleth's Infant School and Dangan School. The project is to find out if fitness levels alter over the school year.

Why has my child been chosen?
Your child has been chosen because he/she is a healthy child in the 6-7 age bracket.

Do I have to take part?
It is up to you to decide whether or not your child takes part. If you decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason. A decision to withdraw at any time, or a decision not to take part, will not affect your child in any way.

What will happen to the children who take part?

Your child will get the opportunity to partake is four short fitness tests at the beginning of each term and at the end of this school year, measuring endurance, flexibility, balance and strength.

The tests will take place on:

- September 4th 2012
- January 8th 2013

- April 8th 2013
- June 27th 2013

All tests are age-appropriate and will be undertaken in a safe and caring manner. Results will be calculated to see if fitness levels have changed throughout the year. No-one will be identifiable in the final report.

What are the possible disadvantages and risks of taking part?
There are no disadvantages or risks foreseen in taking part in the study.

What are the possible benefits of taking part?
By taking part you will be contributing to research on how children's fitness levels can be enhanced over the school year period.

What if something goes wrong?
If you wish to complain or have any concerns about any aspect of the way your child have been approached or treated during the course of this study, please contact Professor Sarah Andrew, Dean of the Faculty of Applied Sciences, University of Chester, Parkgate Road, Chester, CH1 4BJ, (44) (0) 1244 513055.

Will my taking part in the study be kept confidential?
All information which is collected about your child during the course of the research will be kept strictly confidential so that only the researcher carrying out the research will have access to such information.

What will happen to the results of the research study?
The results will be written up into a dissertation for my final project of my Master's in Exercise and Nutrition. Children who participate will not be identified in any subsequent report or publication.

Who is organising the research?
The research is conducted as part of your child's physical education programme and will be recorded in fulfilment of an MSc in Exercise & Nutrition Science within the Department of Clinical Sciences at the University of Chester. The study is organised with supervision from the department, by Claire Heneghan, First Class Teacher in St. Conleth's Infant School and an MSc student.

Who may I contact for further information?
If you would like more information about the research before you decide whether or not you wish your child to take part, please contact:
Ms. Claire Heneghan (School Phone Number: [redacted])
Thank you for your interest in this research.

Appendix 6: Consent forms for parents/guardians

University of Chester

Title of Research Project

Evaluation of children's fitness levels across the first year of primary school

Name of Researcher

Ms. Claire Heneghan: First Class Teacher, St. Conleth's Infant School

	Please initial box
1. I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions.	☐
2. I understand that my participation is voluntary and that I am free to withdraw my child at any time, without giving any reason and without my legal rights being affected.	☐
3. I agree for my child to take part in the above study.	☐

_____	_____	_____
Name of Participant	Date	Signature

_____	_____	_____
Researcher	Date	Signature

Appendix 7: Written permission from relevant personnel (School A and School B)

Scoil Naomh Chonnlaodh Naíonáin,
Droichead Nua,
Condae Chill Dara.
Guthán: 045 - 431050
Fax: 045 - 431050

SOLI DEO GLORIA

St. Conleth's Infant Primary School,
Newbridge,
Co. Kildare.
Phone: 045 - 431050
Fax: 045 - 431050
Email: conschool.ias@eircom.net

To Whom It May Concern,

I, Mrs. Margaret Harnett, Principal of St. Conleth's Infant School, is delighted to give permission to Ms. Claire Heneghan to perform fitness tests on her first class children at the beginning of each term for the 2012-2013 school year. I also give consent to release her for fitness testing in Dangan National School at the start of each term of the 2012-2013 school year.

Yours sincerely,

[redacted]

Margaret Harnett

Dangan National
School,
Newbridge,
County Kildare
Phone: 045 43152

dangan.school@yahoo.ie

Emailed: 24th May 2012

To Whom It May Concern,

I give consent to Ms. Claire Heneghan of St. Conleth's Infant School, to test fitness levels of the children from first class for each term of the 2012-13 school year.

Yours truly,

Mr. Vincent Brennan

Principal

<u>Appendix 8</u>: Risk Assessment Procedures

Policy on Play-time Supervision

1. Each teacher is aware of the following rules for playtime

- No child may leave the playground.
- A child may not climb on any railings or run on the wheel chair ramps
- No rough play is tolerated – i.e. bumping, trains, shoving or kicking – any imitation of Kung-fu/Power Rangers type behaviour is strictly forbidden.
- No child is allowed back into their classroom

2. Each teacher must be proactive when embarking on yard duty, patrolling the yard thoroughly and checking toilet areas at least one or two times.

Playtime

- All children are expected to play in a safe way during play-time, to listen to instruction and obey any instructions/warnings given by teachers and staff members on playground-duty.
- If a verbal warning is given, the unacceptable behaviour is explained and the child is told that they will have to sit/stand if this behaviour continues.
- A teacher may ask the child to accompany her for a period of time and not allowed to play.
- If a pupil is asked to sit/stand out for second time during the week, the pupil will go to Principal to be assigned age –appropriate sanctions as deemed appropriate.
- If unacceptable behaviour persists, parents/guardians will be asked to attend a meeting with the Principal and teacher.
- The teacher will report any serious behavioural incidents to the relevant class teacher.
- Children must ask permission from the teacher on duty, to use the toilet.
- At the beginning of break, the teacher on duty on each yard blows a whistle, asks the children to freeze and briefly outline expected good behaviour.

- The teacher must make a written statement (in copy in secretary's office) on all reported accidents, whether witnessed or not.

Reporting of accidents/incidents during playtime

1. Each of the 3 yards has a separate "Incident Book"
2. Teachers going on playground duty take the relevant "Incident Book" with them.
3. Any serious incident and the children involved in such is recorded in the book.
4. Children who persist in rough play or continually disobey the playground rules also have their names recorded.

Emergency Procedure

Emergencies Include:

- Child goes missing from the playground.
- Abduction/ attempted abduction of a child or adult in school/playground.
- Any incident that Principal deems an emergency.

Action Plan:

- Incident to be reported immediately to the Principal/Deputy Principal.
- Principal alerts the Emergency Response Team through intercom system or by delegating nearest adult on site to alert team by word of mouth.
- Members to carry out search of designated areas for 10 minutes before reporting back to the secretary.

The risk of the children hurting/injurying themselves during fitness testing will be alleviated by:

1. A proper warm-up procedure.
2. Each test will be conducted in a safe environment, with precise instruction given.
3. The children will be supervised at all times during play-time and fitness testing.